ATI 9000 Pro Reviewed ◆ NVIDIA NV30 CineFX Sneak ◆ Taste The Flavors Of Linux

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VIA Technologies' WenChi Chen

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- Kyle Bennett
- Chris Pirillo
- Pete Loshin
- Lisa Lopuck
- Joan Wood
- Alex St.John
- Rob "CmdrTaco" Malda

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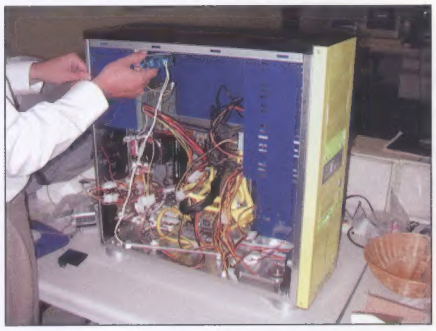

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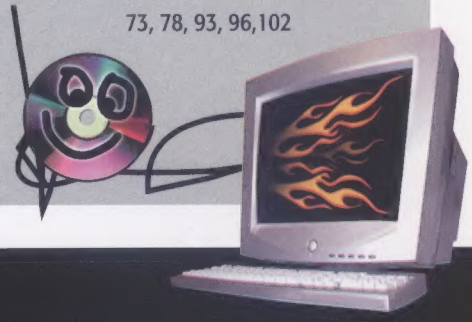

Greetings From Samitland

We're officially entering the autumn months with seemingly only a short time before the onslaught of the holiday season. But that's a good thing, of course. That's right, baby, manufacturers will be gearing up to launch tons of products, and what could be more exciting than hotly anticipated hardware and software? (Well, OK, maybe winning the lottery would be more exciting; then again throwing money at monkeys in a bank has just never been as entertaining as playing with the latest gear.)

The kicker this month is we have a ton of soon-to-be essential products to keep you occupied until then, in addition to all the other goodness you've come to expect. I'm hoping we'll be able to serve you even better with what we have planned for the rest of the year. But for now let's focus on this month. On pages 19 to 21 we look at NVIDIA's SIGGRAPH presentation of NV30's CineFX, the Matrox Parhelia-512, and a video card that will please those of you brassed off with GeForce4 MX-based cards: the ATI 9000 Pro (based on the RV250 chip). Oh, and there's more. You've probably been hearing a lot about NVIDIA's Cg (C for graphics), eh? Well, we've cut out the jargon and presented it so you can see what's really going on with the technology. Let's not forget our Spotlight on next-gen networking (page 50), our Linux distro roundup (page 70), and our Back Door interview with the thorn in Intel's side, VIA Technologies' top dog WenChi Chen (page 108).

All told, I think you'll find plenty to keep you busy this month. And once again, thanks for the feedback. We read it all and endeavour to reply to as many as we can, but don't take offense if you don't hear back. After all, we have to make time to put together a magazine for you every month. As I've said in the past, your praise and criticisms help shape the magazine, so please keep them coming. Ta.

Samit G. Choudhuri, Publication Editor, *CPU*

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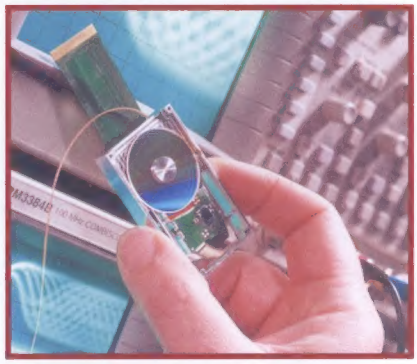
Compiled by Marty Sems

In Hardware . . .

You're 3cm, You're 1GB, And You're Mine



How many times have you said, "Wish they made really tiny CD-Rs"? Philips just might.

Photo courtesy of Philips Research

In June, optical disc pioneer Philips showed off a fascinating prototype of future personal storage. Whereas IBM has had a lock on 1-inch, 1GB hard drives for years with the Microdrive, Philips demonstrated a 1GB optical disc of about the same size. Philips' matchbox-sized prototype drive used a 405nm blue laser to play MP3 music from the new 3cm disc, indicating that the company probably intends the storage medium for music players and other personal devices. If Philips can sell recordable discs at prices comparable to CD-Rs and CD-RWs, the new tiny disc format could give flash memory or 500MB DataPlay cartridges strong competition. ▲

Microsoft Going Wi-Fi

Yes, Microsoft is planning to launch its own Ethernet and 802.11b broadband home networking devices this fall. Yes, we've played with several of the products the company will likely bring to market. And no, we can't tell you what we've seen just yet. However, Microsoft Hardware Division general manager Randy Ringer dropped a few hints just before press time, saying the company aims to make its wireless gear easier to set up than the products typical today. In contrast to Bill Gates' famous "security" email, however, Ringer described security, especially wireless security, as "a tradeoff between safety and performance." ▲

The TuXbox

The Xbox Linux Project said in early July that an anonymous donor pledged to pay as much as a total of $200,000 to the first developers who complete certain Linux-to-Xbox porting tasks by the end of the year (xbox-linux.sourceforge.net). Days later, the Project reported the first Linux program to run on an Xbox without using the legalese-bound Xbox SDK. The prize money gives developers some incentive to legally bring Linux first to a modified Xbox and then to an unmodified one via boot CD. See "Killer Hardware Tips" on page 101 of this issue for more.

In other Xbox news, Thomson recently announced RCA television sets with a VPORT connector supporting the Xbox's component video output (www.thomson-multimedia.com). Models range from $349 to $1,499 and from 20-inch screens to 36-inch monsters. ▲

After you've won the Xbox-Linux porting prize money, go buy an Xbox-ready RCA big screen for your trouble.

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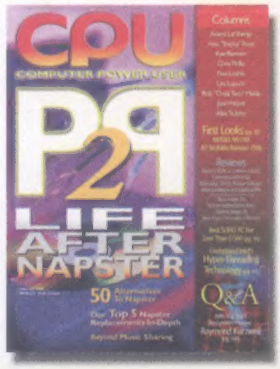

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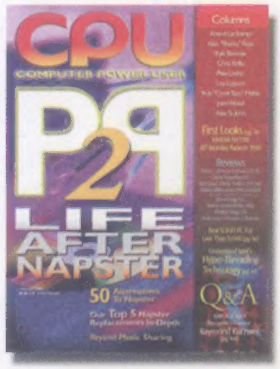

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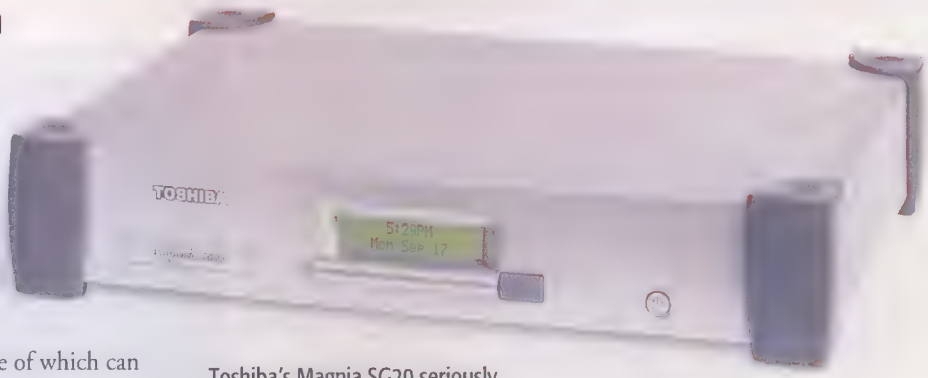
Convergence Gets Fun

Two hot gadgets for power users are jukebox servers and ever more feature-rich wireless routers. Toshiba now offers a combination of both in a single box. Its Magnia SG20 Wireless Media Center ($1,285 to $1,885; www.toshiba.com) is an 802.11b access point with an optional PC Card, a 7-port 10/100Mbps switch, and a firewall with VPN support and IP and keyword filtering. It's also a server with as many as two 30GB hard drives, one of which can store an image of the other. The Magnia can serve up your MP3s or WMAs to your AudioTron, PC, or Pocket PC devices. A Celeron, 128MB of SDRAM, and Red Hat 7.0 are inside. ▲



Toshiba's Magnia SG20 seriously reduces the number of power-user gadgets you need.

Serious, Serial Storage

New hard drives with 60GB per platter are arriving from Seagate, Samsung, and Western Digital. Making things more interesting, WD just grabbed the capacity crown with a new 200GB 7,200rpm Caviar.

Meanwhile, support for the EIDE interface's successor Serial ATA is coming soon in controllers and motherboards, while a native SATA version of Seagate's Barracuda ATA V hard drive will arrive this fall. We checked out this drive and some SATA cards and cables at Intel's pavilion at TECHX-NY in June. The slightly L-shaped connectors on 7-pin SATA cables have some leads shorter than others to prevent full current coming online at once during hot-plugging. ▲

Hardware Mole

Our endearingly myopic hardware mole always has one ear to the ground. Here's his scuttlebutt at press time.

Dynamic Duo (Er, Static, Actually)

Sony was about to officially unveil its smaller Memory Stick, dubbed the Duo, at press time. If Sony named the MS after a stick of gum, consider the Duo a Chiclet. Look for the Duo to help Sony compete against SD and MMC-based portable gizmos. Meanwhile, our mole pressed his nose against the glass at TECHX-NY, catching sight of an extremely small, Duo-based personal music player. Among other gadgets on display, there was a tiny Sony Ericsson Memory Stick smart phone/music player and a bulbous, orange plastic music player that resembled one of the bugs in the old Cootie game.

Red Storm Rising

In June, Sandia National Laboratories began negotiations with Cray to make a new supercomputer. The new massively parallel processing system will be called "Red Storm." Sandia Labs, of the Department of Energy's National Nuclear Security Administration, expects the project to take at least two years at a cost of approximately $90 million. A spokesman could not comment on the negotiations nor Red Storm itself by press time, although Sandia expects the contract to be finalized by the time you read this.

Tinier Transistors Through APF

Semiconductor innovator Applied Materials introduced new lithography technology in June for creating smaller transistors. The company says that its new Advanced Patterning Film masking solution could let semiconductor manufacturers create transistor gates smaller than 50nm using DUV (deep-ultraviolet) lithography. The APF solution is of the CVD (chemical vapor deposition) type and combines an amorphous carbon film with a nonconductive, nonreflective layer. Applied Materials claims APF should enable fine control over structure detail at a low cost.

Applied Materials' new Advanced Patterning Film masking solution could facilitate sub-50nm transistor gates, leading to smaller, faster semiconductors.

To continue the tradition established way back in July 2002, we bring you a page of the choicest chip news. Enjoy!

Take 2

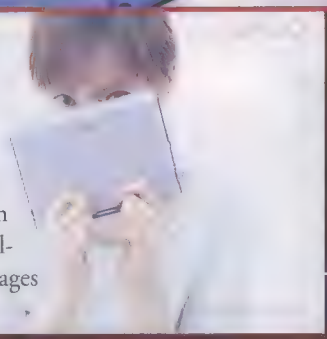
Intel's new 64-bit Itanium 2 debuted in early July in workstations and servers from HP and others. The formerly cKinley chip, which has as much as 3MB of L3 cache and a current 1GHz top speed, has its work cut out for it. Intel pinned a lot of hopes on the original Itanium's success, but an industry spending slump and so-so performance kept the chip from storming the lucrative 64-bit processor market.

A few weeks earlier, Intel showed off its new 2.53GHz P4, its 2GHz mobile P4-M, and its 845G chipset with improved integrated graphics.

Can the faster Itanium 2 win more converts than its predecessor?

An Evening With Transmeta

Transmeta showed off scads of Crusoe-equipped products—including upcoming tablet PCs and Japan-only notebooks—at a June shindig in Rockefeller Center. Chief among them in coolness was the paperback novel-sized OQO, a real 1GHz WinXP handheld computer previewed in these pages in July's issue. Meanwhile, Sony packed an 867MHz Crusoe into its VAIO-U PCG-U1 "ultra-subnotebook." Another exhibitor told us that Transmeta's fanless Crusoe would revolutionize blade servers, allowing thinner blades and higher densities.



Transmeta's low-power, low-heat Crusoe makes possible dinky PCs such as Sony's VAIO-U PCG-U1.

Senator, I Guess I Do Have A Memory Of That

Memory maker Micron sent out a press release in June confirming that the DOJ Antitrust Division subpoenaed it for a grand jury appearance as part of an investigation of the DRAM industry. Details are few, but speculation is plentiful, mostly centering on the appearance of price fixing due to the dwindling number of large manufacturers and the DRAM price surge in the first part of this year. Later, the Federal Trade Commission filed antitrust charges against litigious memory designer Rambus, asserting the company improperly filed patents on SDRAM technologies during its participation in the JEDEC standards body.

Watching The Chips Fall

Here's a rundown of the latest AMD and Intel CPU pricing information compared with initial release prices and last month's prices.

CPU	Released	Original Price	Current Price	Last Month's Price
AMD Athlon XP 1600+	[illegible]	[illegible]	[illegible]	[illegible]
AMD Athlon XP 1700+	10/09/2001	$190	$69	$157
AMD Athlon XP [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
AMD Athlon XP 1900+	11/05/2001	$269	$107	$220
AMD [illegible]	01/07/2002	[illegible]	[illegible]	[illegible]
AMD Athlon XP 2100+	03/13/2002	$420	$161	$330
AMD Athlon XP [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	6/10/2002	[illegible]	[illegible]	[illegible]
Intel Pentium 4 1.5GHz	11/20/2000	$819	$120	$133
Intel Pentium 4 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Intel Pentium 4 1.7GHz	04/23/2001	$352	$129	$141
Intel Pentium 4 1.8GHz	[illegible]	[illegible]	[illegible]	[illegible]
Intel Pentium 4 1.9GHz	08/27/2001	$379	$161	N/A
Intel Pentium 4 2GHz	[illegible]	[illegible]	[illegible]	[illegible]
Intel Pentium 4 2.2GHz	01/07/2002	$562	$233	N/A
Intel Pentium 4 2.4GHz 400MHz FSB	04/02/2002	[illegible]	[illegible]	[illegible]
Intel Pentium 4 2.26GHz 533MHz FSB	05/06/2002	$423	$265*	$423
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	05/06/2002	[illegible]	[illegible]	[illegible]
Intel Pentium 4 2.53GHz 533MHz FSB	05/06/2002	$637	$618*	$637

In Software . . .

Sorry, Judge

Eerie quiet has settled on the courtroom drama between Microsoft and the states that chose not to accept the Department of Justice settlement proposed last November. In June, U.S. District Judge Colleen Kollar-Kotelly asked the parties to prioritize both sides' remedy proposal provisions before closing arguments. The states complied, setting disclosure of Windows code to enhance software interoperability as more important than other provisions, such as protecting OEMs from overly restrictive contracts or retaliatory business practices and a demand for a stripped-down version of Windows. Microsoft declined to comply with the order, with attorney John L. Warden saying of the states' proposal that "some provisions would be more destructive than others, but it's a tightly interrelated hole that would be truly disastrous. . . ."

On another front, Kollar-Kotelly issued a memorandum in early July concerning the revised Microsoft/DOJ settlement agreement. The judge stated that the Tunney Act antitrust legislation applied to the case, and that both Microsoft and the Department of Justice had complied with the Act's provisions. The latter meant that the judge found both parties properly comported themselves during the proceedings. Next, Kollar-Kotelly is expected to determine if the proposed settlement is in the public interest. ▲

Software Shorts

Here are a few software tidbits we found just before press time.

That's Not Red-eye, It's A Virus

McAfee.com reported the first JPEG virus in June, dubbed W32/Perrun. It's considered a low-risk proof of concept, but more harmful variations will probably emerge. W32/Perrun, which doesn't spread itself over networks as does a worm, arrives in two parts. The payload exists in the JPEG code causing a noticeable corruption, while a separate extractor component spreads as an EXE file. This extractor must exist in a PC's Registry to enable the virus to spread to other local JPEGs. McAfee.com said the virus's author also developed a similar virus infecting EXE files, demonstrating that heretofore "safe" file types may not be safe for long.

ArcSoft's Suite Deal

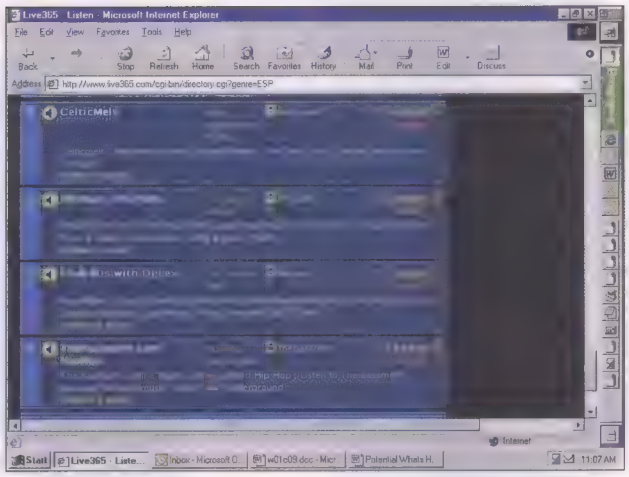
In the antivirus business model, you pay to keep your software current, giving the publisher a steady revenue flow. ArcSoft put a twist on this lucrative arrangement with a new pricing scheme for its photo- and video-editing apps. You can buy up to 12 of ArcSoft's software titles, such as PhotoStudio 4 and ShowBiz 1.1, for $99.99 or less (introductory pricing). You'll get free updates and upgrades for all of them for one year. After that, you can extend your update period at a discounted price or just keep using your apps as they are for no extra cost.

Wal-Mart Opens Its Lindows

It took a retail giant such as Wal-Mart to flout a software behemoth such as Microsoft. Earlier this year, the chain made headlines selling PCs without OSes, which Microsoft has long claimed encourages piracy. Now, Wal-Mart is selling Microtel PCs preloaded with LindowsOS, a Debian-based OS intended to include the best aspects of both the Linux and Windows operating systems. PC prices range from $299 to $599, giving customers a choice of Athlon XP, Pentium 4, Duron, or Celeron processors.

Internet . . .

A Dirge For Web Radio



The retroactive nature of the new Web radio royalty fees may drive small operators, such as some on Live365.com, out of business.

After arbitration, remonstration, and speculation, there may finally be a decision on the fate of Web radio. The Recording Industry Association of America and others pressed the U.S. Copyright Office to set a retroactive fee schedule to force Web radio station operators to pay royalties on the music played since 1998. Webcasters objected to the RIAA's proposed retroactive fees as too high for the majority of Webcasters to afford. The RIAA argued that Webcasters should not be allowed to stream copyrighted music to a potentially worldwide audience for free.

A Copyright Office-commissioned Copyright Arbitration Royalty Panel (CARP) in February recommended a 0.14 cents-per-song performance fee, retroactive to 1998. However, the Librarian of Congress in June decided on a 0.07 cents-per-song performance retroactive fee, the same fee adopted for simultaneous Internet retransmission of an AM or FM radio broadcast. The Librarian of Congress' decisions on this and related fees went further toward the Webcasters' position than the CARP's recommendation but still may force many smaller Web radio operators out of business.

Cash On The (Digital Gun) Barrel

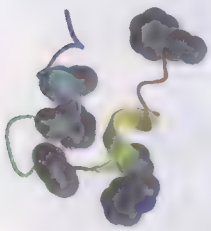
Looking for a persistent online game world with free software and no subscription fee? Sweden-based MindArk is aiming for just that with Project Entropia (www.project-entropia.com). However, there's a twist. Players buy PED (Project Entropia Dollars), the game's currency, for real money. MindArk gets a percentage of in-game transactions. If fully realized, this means that there will be online gaming entrepreneurs making money buying and selling things in the game, without the online auctions necessary to do so in EverQuest or Ultima Online.

Dust off your credit card and greet your new "job."

Unfortunately, reality hasn't been kind to MindArk's brainchild, in beta tests since May. Despite technical problems, outages, and angry players with lost accounts, a company press release optimistically predicts 25 million users in four years, all of whom will spend between $4 and $8 per hour when online. Even more optimistic is MindArk supervisory board chairman Benny Iggland's assertion that millions of dollars in proceeds from a possible lawsuit against Microsoft and the Business Software Alliance (whom MindArk blames for a software license raid on its headquarters) would be scattered as prizes throughout the game for players to find.

Folding@Google

Lauded search engine Google has taken a step forward with its opt-in distributed computing client, switching on Google Compute (toolbar.google.com/dc) for a limited number of randomly selected beta testers. If you have downloaded and are using Google's toolbar, you might be invited to download Google Compute, which lets you choose to let Google use your PC's idle processing cycles to aid scientific research. Google Compute's first pet project is helping Stanford University researchers understand the structures of proteins as part of the Folding@Home project, which could lead to progress on cures for diseases such as Alzheimer's. Google says other nonprofit distributed computing projects will follow.



Google Compute's designers knew that altruistic people usually like to know their contribution is being put to good use, so they included a DNA icon that appears in the toolbar when your PC is folding proteins. The icon even tells you how your PC is progressing on the problem when you hover your mouse pointer over it. Google Compute only works with IE 5 or later thus far on Win98/Me/2000/XP systems.

Google Compute may soon offer you an easy way to donate processing time to scientific research.

New On The 'Net

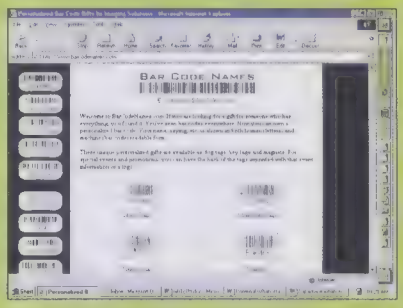
Looking for some new surfing destinations? Here's a sampler of the many sites that recently hit the Web.

Compatibility Counseling

Struggling to get Linux, Unix, and Windows to work together in your company? StarNet has launched a new IT resource site to help you. X-Solutions.com offers software with interoperability in mind, including antivirus, firewall, and terminal emulation titles, all with free trial versions. The site also features a trade show database (one that isn't limited to just technology shows) and plenty of links to Linux and Unix resources.

Material World

Got a friend who is too materialistic for his own good? Celebrate his commercialism (or just make fun of it in an oblique way) by giving him a gift from BarCodeNames.com. The site will turn his name into a barcode similar to the UPC codes on everything on the store shelves and put it on a dog tag, key tag, or magnet.



Sure, a barcode nametag is kind of useless, but so is a lot of the stuff your friend brings home.

All Your Racing Trophies Are Belong To Us

Many of us had our first introduction to Japanese animation, or anime, with the bizarrely campy cartoon "Speed Racer." Relive those lava-plagued racetrack thrills with Speed, Trixie, and the spastic monkey Chim Chim on the newly redesigned SpeedRacer.com site. You'll find character and car galleries, wallpaper and screen savers, and perhaps upcoming content such as memorabilia auctions and an interactive Mach 5 super car. Personally, we can't wait for the forthcoming description of the "Motorcycle Apaches" episode.

BIOS Upgrades Available Online

Before you send another motherboard to the landfill, consider upgrading the BIOS and giving your PC a new outlook on life. Here are a few recently released upgrades. Check out www.smartcomputing.com/cpumag/sep02/bios to see the entire upgrade list.

MFR	File (Date Available)	URL
AOpen	AX4BS-V version R1.07 (06/20/2002)	www.aopen.com/tech/download/mbbios/ax4bsv.htm
AOpen	AX4B version R1.05 (06/20/2002)	www.aopen.com/tech/download/mbbios/ax4b.htm
AOpen	AX4B Pro version R1.05 (06/20/2002)	www.aopen.com/tech/download/mbbios/ax4bpro.htm
AOpen	AX45-533/AX45-533N version R1.01 (06/27/2002)	www.aopen.com/tech/download/mbbios/ax45533.htm
AOpen	MX46L version R1.01 (06/25/2002)	www.aopen.com/tech/download/mbbios/mx46l.htm
AOpen	MX36LE-U version R1.10 07/09/2002	www.aopen.com/tech/download/mbbios/mx36leu.htm
AOpen	MX36LE-UN version R1.10 07/09/2002	www.aopen.com/tech/download/mbbios/mx36leun.htm
AOpen	MX3S-T version R1.08 06/25/2002	www.aopen.com/tech/download/mbbios/mx3st.htm
AOpen	AK77-333 version R1.09 (06/25/2002)	www.aopen.com/tech/download/mbbios/ak77333.htm
AOpen	AK75 version R1.02 (06/20/02)	www.aopen.com/tech/download/mbbios/ak75.htm

Compiled by Nina Smith

You Get PAID For That?

Game Designer
Nintendo

Why settle for playing Mario Kart: Double Dash!! on the GameCube when you could be [illegible] Nintendo's next hit game? Nintendo of America is looking for a game designer who can oversee all aspects of a title's development, from [illegible] and storyline to the [illegible] and gameplay. What do you need to know to get this sort of plum job with one of the world's most respected game design studios? A little of everything, according to the job description. Be familiar with video game hardware and software, have [illegible] years of experience in creative [illegible] and be able to [illegible] and Nintendo's current development tools. Understand the software engineering process. Write and speak well. Be able to communicate ideas and [illegible] to multiple audiences. Have a "can-do attitude" and a sense of [illegible]. Possibly most of the duties we know only professionals in these environments, they do a good job. What's that you think they're really looking for? Well, we'll let you in on a little secret. ▲

Raw Data

527,000

Number of unique users visiting the official FIFA World Cup Soccer site during the week ending June 2, 2002

Nielsen/NetRatings

412%

Percentage of growth over the past 12 months in the number of sites offering streaming media, including online movie trailers

Websense, June 2002

41 million

Number of home Internet surfers using instant messaging applications in May 2002

Nielsen/NetRatings

33%

Share of worldwide Internet users from Asia-Pacific region in 2001

eMarketer

22%

Percentage of online shoppers who make their purchases from work in 2002, up from 12% in 1999

Consumer Electronics Association

14 million

Number of people projected to be playing online games by 2006

DFC Intelligence

We're All Media Moguls, Now

Longtime media consumers become media producers when they get their hands on high-speed Web access. It isn't surprising that home broadband users download images, music, and games as avidly as seniors scarf the free shrimp at a Shoney's smorgasbord. More striking is that speedy surfers fill these fatter pipes with their own content, swapping files, posting images, and creating Web pages more often than their bandwidth-challenged fellows. The real digital media revolution may be about users taking control of their mediasphere by creating and managing content in ways that film, radio, print, and television never allowed. How much will that broadband access account change what you do online in a typical day? A lot, according to the Pew Internet and American Life comparison of the percentages of high-speed and dial-up users who engage in various online activities on a typical day. ▲

Share Computer Files With Others
Broadband: 17% • Dial-up: 4%

Download Games, Videos & Pictures
Broadband: 22% • Dial-up: 4%

Use A Chat Room
Broadband: 10% • Dial-up: 5%

Create Content (Web Pages, Message, Or Image Posts)
Broadband: 16% • Dial-up: 3%

Online Several Times A Day
Broadband: 43% • Dial-up: 19%

Source: Pew Internet and American Life Project

by Alex St. John

Why Software Is Broken

Alex St. John was one of the founding creators of Microsoft's DirectX technology. He is the subject of the book "Renegades Of The Empire" about the creation of DirectX and Chromeffects, an early effort by Microsoft to create a multimedia browser. Today Alex is President and CEO of WildTangent Inc., a technology company devoted to delivering CD-ROM quality entertainment content over the Web.

I had Lasik eye surgery last week to correct my lifelong vision problems: -6 diopters in each eye and a stigmatism. It was painless and quick; 24 hours later I had 20/15 vision. My wife's vision was much worse; she corrected to 20/25. The surgery was largely performed by a computer-guided laser beam; I was in the chair less than seven minutes. The experience was nothing short of miraculous. Sitting in the waiting room at this place was like being in a biblical story with one person after another walking out of surgery in a white robe with (artificial) tears streaming out of their eyes, proclaiming "I can see!" I just wanted to tell everyone how great it is to be able to see with my own eyes again!

Now, back to the featured subject matter of this month's column: busted software. People are always complaining about how busted software is, Microsoft Windows being one of the principal sources of this complaint. I've heard various complaints, including "If Microsoft did a better job of testing," "If their developers weren't so careless," or "I guess you can get away with shipping broken software when you're a monopoly," etc. I also read a lot of the academic technical journals where journalists who haven't spent their whole careers building complex system software speculate erroneously about why software is broken.

All the companies that made 100% stable products lost their business to the folks who made 95% stable products with more capabilities.

The answer is simple: Large, complex software products need lots of people to build them and communication between large groups of people is usually imprecise, incomplete, and inaccurate. In many cases it's also nonexistent, especially on the PC. Consider that on a PC you have CPUs made by two companies, AMD and Intel, who are direct competitors and avoid communicating at all costs. They produce multiple generations of processors which will be integrated on motherboards made by competing companies, and integrated by glue chips provided by dozens of competing vendors, bootstrapped by BIOS software, also written by competing vendors, that Windows then depends on to launch itself. Windows can't even get started without depending on dozens of different device drivers written by dozens of different device providers, and that's not the half of the problem. I didn't even mention the dozens of competing PC OEMs who need to differentiate their products by shipping subtly distinct PC configurations.

Of course, Microsoft has to add some value as well. First it has to try to hide/abstract all of that clutter into a consistent set of APIs that applications can depend on to work. Abstraction, however, means hiding differences between architectures, but one company's "difference" is another's killer feature. Microsoft tries to provide a smooth, contiguous development environment for applications, and competing hardware and software companies try to bypass this continuity to add their differentiating "features" to your system. The result is unimaginable complexity and chaos.

Amplification of this problem is driven relentlessly forward by powerful economic forces. Only companies that are profitable can ultimately be in the business of making hardware and software. Any company that does not make doing this a central focus gets plowed under. Stability is a feature that people expect to get for free; new bells and whistles they will pay for. All the companies that made 100% stable products lost their business to the folks who made 95% stable products with more capabilities. Magazines like *CPU* play an important role in the stability of products by not only meticulously reviewing the feature sets of new products as they reach the market, but also publicly flagging stability problems.

The remarkable thing about the PC is that it is an incredible example of evolution in process. A free market for all of the PC's components combined with the selective economic forces of millions of demanding individual consumers has shaped the PC over 25 years to be the flawed, but dominant computer species. Each generation of the PC and its software is a new attempt to strike the most efficient balance between features and robustness necessary for the companies that make them to survive to produce another generation. ■

Want to provide your own saintly chatter? Go ahead. Write to TheSaint@cpumag.com.

EXTREME HARDWARE

These Gizmos Don't Sing It, They Bring It

Nothing is what it seems. Everything you know is wrong. It's not Phildickian paranoia brought on by our precog Samit's foreknowledge of the movie "Minority Report"; it's just this month's Extreme Hardware. That posh-looking cell phone probably costs more than your car. That odd little MP3 player you bought just might be trying to tell you something—in Latin. And that strange feeling that your refrigerator is not only watching your every move but is also tied into a vast, worldwide network? Yep, you were right.

by Marty Sems

LG Internet Refrigerator

LG Electronics (www.lgappliances.com) is clearly out of control. The Korean manufacturer may be excused for hyping the digital home myth as loudly as anyone in the last 40 years. However, LG's evidence of cranial frostbite is even making an Internet Refrigerator (model number INTERNET007 or GRD-267DTU) in the first place and then declaring it the centerpiece of its Kitchen Of The Future. This otherwise snazzy-looking fridge has a 15.1-inch touchscreen set opposite the ice dispenser—in case you get a hankering for email, video chat, or MP3 downloading as you're trying to decide what to eat. Grab a piece of linoleum to watch television using the INTERNET007's NTSC tuner and four speakers or update your database of food you froze last winter. The tiltable touchscreen features handwriting recognition and an on-screen keyboard. In case a regular fridge and a separate, inexpensive kitchen PC just won't do ya, look for the Internet Refrigerator in September for about $8,000. And yeah, that's a built-in CCD Web cam. No wonder June Cleaver always put on her pearls to do housework.

Vertu Platinum/MMII

There comes a point in every wealthy, successful person's life when mass-produced plastic gizmos no longer suffice. (I'm theorizing here.) He Who Has Arrived wants everything he owns, even his lowly cell phone, to reflect his status and resources. (Again, I'm just guessing. But it's probably true.) He wants a Vertu phone that has the look and feel of the interior of his luxo-sports car. Nokia-partnered Vertu (www.vertu.com) handcrafts really expensive GSM phones out of leather and ceramic, with platinum, gold, or stainless steel appointments. Each has a scratch-resistant sapphire-crystal face, jeweled bearings, and immense jealousy potential for those just below you on the food chain. Vertu phones currently use GSM, which should cover your rich patootie in the United States, Europe, and the Asia Pacific region, but you can have the phone's guts replaced as new technologies emerge. The Platinum/MMII model shown here runs about $22,900. To quote the philosopher Ferris Bueller, "If you have the means, I highly recommend picking one up."

SanDisk Industrial Grade Flash Memory

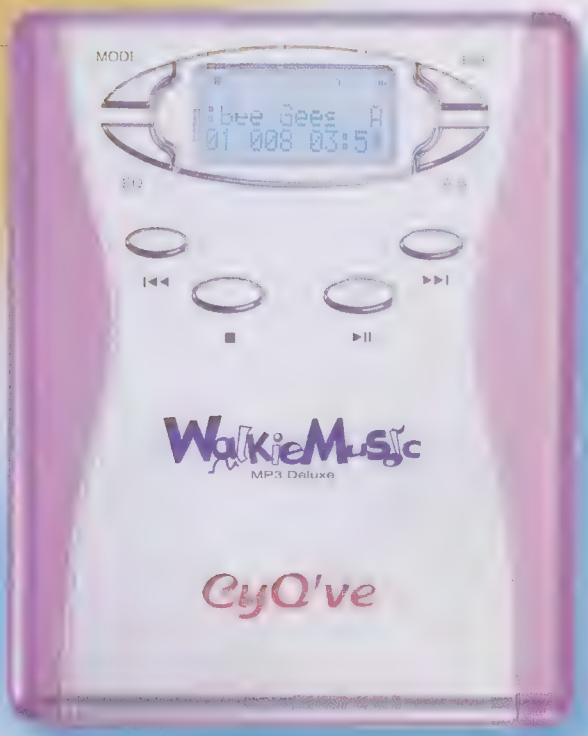
Is destruction in your blood, even when you're not trying? Is your spare room littered with short-lived electronic devices you've accidentally mangled? SanDisk (www.sandisk.com) can help. The company's new Industrial Grade CompactFlash, PC Card, and 2.5-inch FlashDrive flash memory modules are built for harsh military and heavy industry uses, so they should be more likely to survive you. SanDisk says Industrial Grade CompactFlash units, starting at $21 for 16MB, can take as much as 3,000Gs of abuse. At least you'll have one less thing to replace when you inadvertently use your digital camera to stop your trunk lid from shutting.

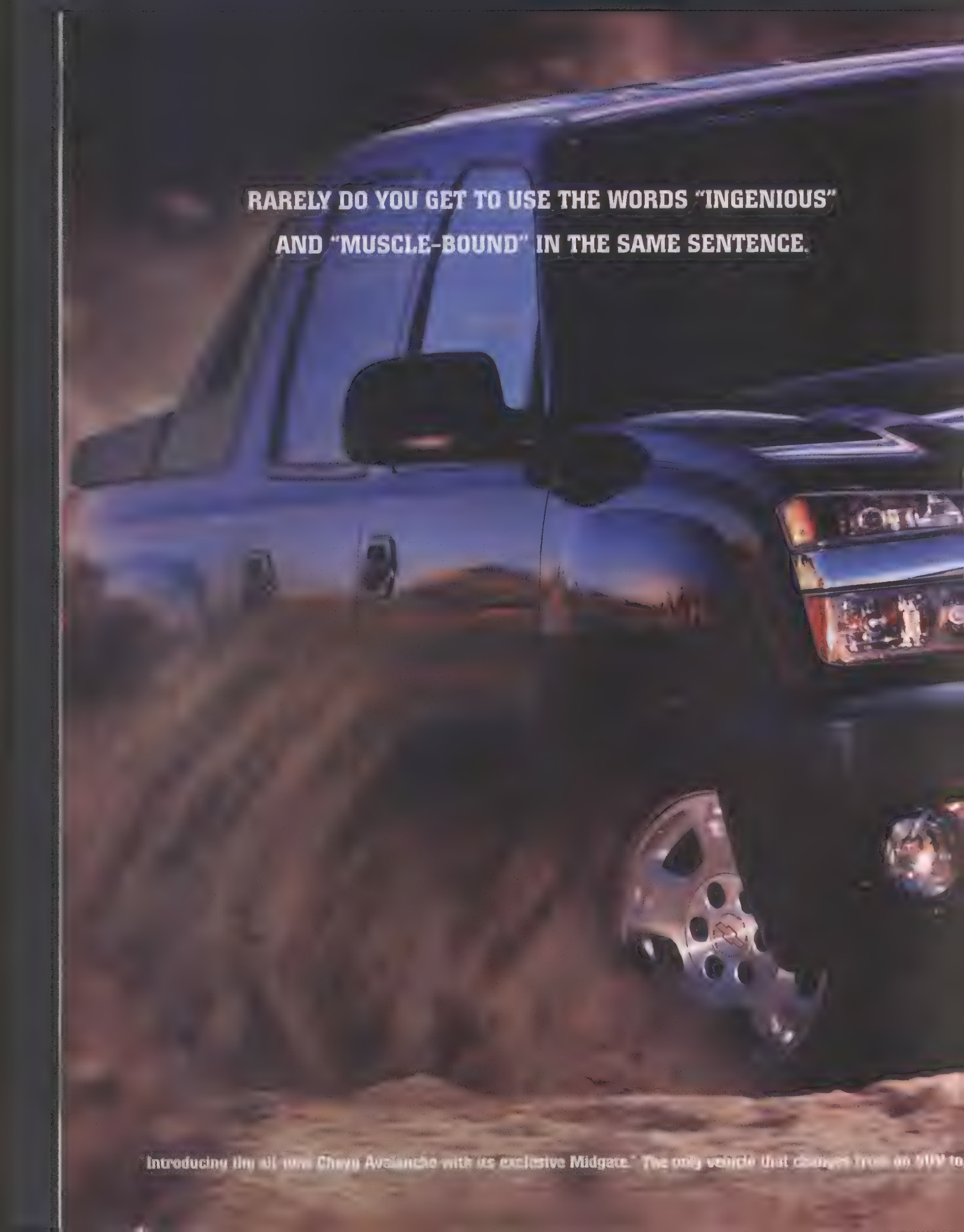
DSI HandGear

Few are more versed in expressive gestures than *CPU*'s design department. Shortly after any given editorial meeting, we can always count on our graphic arts friends for a few gestures that sum everything up. Canadian company DSI Datotech Systems (www.dato.com) has tapped this skill in its HandGear input pad (about $585). Think of it as a USB digital graphics tablet without a pen. Using natural hand motions on the force-sensitive pad, digital designers can harness their nonverbal eloquence by "grasping" on-screen objects and navigating about. The HandGear has plug-ins for art and CAD/CAM apps, such as discreet's 3ds max and Autodesk's VIZ 4, with others on the way. If only Jackson Pollock had had access to a HandGear, he wouldn't have been tragically reduced to flinging paint all over the garage.

MET CyQ've WalkieMusic MP3 Player

Everywhere you look, somebody is sneaking something redeeming into the things you enjoy. They put vitamins in your Crunch Berries. They put pithy "life lessons" at the end of your "Ninja Turtles" episodes. And now there's an MP3 player that can help your little brother convince Mom to buy it for him as an, ahem, educational tool. MET (www.met.com.tw) has added a "language learning" capability to its CyQ've WalkieMusic mini-CD player (about $129) to help your brother crack that impossible nut we call Spanish. When pressed, MET admitted that the WalkieMusic's "Peer to Peer Repeat" feature is better known as A-to-B repeat, or the ability to repeat fragments of audio tracks, such as "No se: I don't know." A-to-B repeat has long been lamentably absent from home audio CD players, possibly because of too many college kids giving each other napmares with really quiet, endlessly looped Pink Floyd passages. MET is pitching the WalkieMusic's potential to big names in the language lesson record industry, but for now, your lil' bro will have to make his own multilingual mini-CDs on a compatible burner. Or just listen to a lot of Santana while ogling Shakira's liner notes.




RARELY DO YOU GET TO USE THE WORDS "INGENIOUS"
AND "MUSCLE-BOUND" IN THE SAME SENTENCE.
Introducing the all-new Chevy Avalanche with its exclusive Midgate.™ The only vehicle that

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PROUD SPONSOR OF THE 2002 U.S. OLYMPIC TEAM
USA
AVALANCHE
LIKE A ROCK

CPU First Look: Preview

Rambus RIMM 4200

RIMM 4200
No Price Available
Rambus
(650) 947-5001
www.rambus.com
Preview: No Rating

It's been a rough journey for Rambus, and it has taken some time for its RDRAM technology to gather steam. Intel originally conceived the PIII to be RDRAM-based with the i820 (El Camino). But with PC800 RDRAM (RIMM 1600) modules originally costing $800 for 128MB, end users weren't exactly chuffed. Technically speaking, the PIII wasn't really well matched for RDRAM anyway, especially where price and performance were concerned. Now it's a different tune: PC800 RDRAM can be found almost identically priced to newer DDR memory modules and, when coupled with the bandwidth-hungry P4, offers up the best-performing platform with the rarer PC1066.

One of the drawbacks of current dual-channel architecture i850E-based systems is that RDRAM modules today sport a single 16-bit channel and therefore must be installed in pairs to populate both RDRAM channels to actually get the desired 4.2GBps available with PC1066. A single 16-bit PC800 stick's peak bandwidth is 1.6GBps but when used in the real world with an identical module, allows for 3.2GBps. The need for matched pairs makes simple upgrades expensive and annoying. Intel has yet to validate the i850E to operate on a 533MHz memory bus, which makes finding better-performing PC1066 tough and expensive. Even so, ASUS, ABIT, and many other OEMs have replaced the clock generator, letting you manually adjust speeds to allow for PC1066, which is a fine interim solution for overclockers but probably not for everyone. Enter the RIMM 4200.

RIMM 4200 runs at 1066MHz, combining two 16-bit RDRAM channels into one 32-bit sandwich that supports dual channel data transfers. Two separate RDRAM channels work independently inside each RIMM, allowing i850E to interface with one bank of 32-bit RDRAM. These 32-bit banks consist of two compressed 16-bit RDRAM buses; thus, neither the RDRAM module nor the chipset requires changes to employ a 32-bit module, which in theory makes life easier for motherboard OEMs.

Bandwidth peak of a single unit is now a calorie-rich 4.2GBps, which not only doubles single module bandwidth but also matches up nicely with the P4's current peak 4.2GBps bandwidth, giving you a truly synchronous match. RIMM 4200 modules have built-in channel termination, which saves space and simplifies motherboard design. The extra real estate could possibly be used for four-layer uATX designs or adding bells and whistles such as IDE RAID. RIMM 4200 should enable higher-density memory chips using a smaller die size, so larger-sized modules may yet be worthy of your money, especially in the workstation arena. Although the form factor is the same, RIMM 4200 has been keyed differently (one as opposed to two) and harbors more pins (232 instead of 184) to avoid mishaps.

Having played with an engineering sample, a Samsung RIMM 4200, and an ASUS P4T533 board with a beta BIOS, provisional performance was second to none. Perhaps, with more time and further BIOS revisions, performance could get even better. Even so, overclocking the test unit to 150MHz FSB (aka RIMM 4800) was a rock solid affair. Rambus' future road-maps include development of 64-bit RIMM 9600 (9.6GBps) and speeds ranging from 1.2 to 1.33GHz, as well.

But just when you thought it was safe to go back in the water with RDRAM, Intel has changed its swimsuit, no longer sporting the Rambus tankini. With the introduction of the i845 chipsets, along with future support for dual channel DDR down the pike, Intel's roadmaps no longer show much in the way of RDRAM. Then there are ATI, SiS and VIA, each having brought in viable and competitive DDR platforms for the P4 (a close run thing with DDR333). Will the high-end enthusiasts still lap it up? Will more than one major OEM (ASUS) actually announce and subsequently offer i850E boards that support RIMM 4200? Will it be affordable? The truth will be out there somewhere. . . . ▲

How RIMM 4200 Stacks Up

Tested on a WinXP Pro P4 2.4BGHz

	i850E RIMM 4200	i850E PC1066	VIAP4X333 DDR333	SiS 645 DDR333	i845G DDR333
3DMark 2001 default	1503	1435	1256	10894	1057
Internet CC SYSmark 2002	347	348	340	301	322
Office Productivity SYSmark 2002	174	176	170	157	169
Quake III 640 x 480	111	309	[illegible]	284	287
Jedi Knight II 1,024 x 768	111	111	111	108	111
Commanche 4 default	11	11	11	46	11

by Alex "Sharky" Ross

Technology Sneak

NVIDIA NV30 CineFX

Even a tight-lipped technology corporation such as NVIDIA lets its hair down for conference presentations at SIGGRAPH (Special Interest Group on Computer Graphics and Interactive Techniques), and so we get to nudge a few beans over the edge regarding NVIDIA's next-generation hardware technology, referred to on the company's developer site (developer.nvidia.com) as "NV30 CineFX."

Most of the noise is about 2.0 vertex and pixel shaders because the driving concept behind the NV3x technology is creation of a "cinematic shading GPU." This time around, NVIDIA is aiming for movie-quality rendering capability with no "arbitrary" hardware-imposed limits and has focused on improvements in programmability and precision. A DirectX 9-compliant part (difficult to confirm as final DX9 specs are not public), NV3x actually goes beyond DX9, in part by increasing the resource limits for items such as maximum instructions for vertex and pixel shaders, and through the use of Cg, NVIDIA's high-level shading language. (See "X-ray Vision: Cg Is Now Playing" on page 42.) Though beaten to the DX9 punch by ATI's impressive R300 offering (See Anand's Corner, page 34), NV3x also sports a loaded résumé. Here are some bullet highlights from NVIDIA's technology presentations (no board specs): If some of this grazes your noggin going over, just be happy you're not at SIGGRAPH.

Vertex Processor: The CineFX architecture extends the instruction set to the entire pipeline, making it more flexible in terms of program flow. The expanded vertex processing capabilities include increasing the number of instructions supported to 65,536 (see chart) by the use of data-dependent branching and more instructions, registers, and constants. Dynamic loops and branches provide for true data-dependent control flow. Also added: call and return functions, per-component condition codes, write masks, and user clip-plane support. New vertex shader instructions and capabilities include high-precision trigonometric functions and high-precision exponentiation and logarithm functions.

Pixel Processor ("Fragment Processor"): Both DirectX and OpenGL are moving toward unified vertex and pixel (fragment) processors. Instructions previously reserved for vertex processing are now available for pixel shading using the same syntax, extended with instructions necessary for pixel processing. Unlike vertex programs, fragment programs are stored in video memory, lowering overhead. Swizzling and conditional write masks have been added, along with a full set of arithmetic instructions. Flexible texture mapping allows computed texture coordinates, nested to arbitrary depth; multiple uses of a single texture unit; and optional LOD control. Other goodies: read access to window-space position, read/write access to fragment Z, built-in derivative instructions (useful for AA), and conditional fragment-kill instruction. Some limitations: no branching, no indexed reads from registers, and no memory writes.

Shading Procedurally. "Look ma, no texture maps!"

NV30 CineFX
NVIDIA
(408) 486-2000
www.nvidia.com

128-bit Floating Point Color Precision: NV3x offers both 16-bit and 32-bit floating-point numbers for each RGB component, creating 64-bit or 128-bit color. The FP16 and FP32 formats give developers flexibility. Although FP32 offers the ultimate image quality, delivering true 128-bit color, NVIDIA thinks FP16 provides optimal balance of image quality and performance for twitch games.

Bandwidth: High Speed DDR2 memory and AGP 8X support along with NVIDIA's 4:1 lossless Z compression and (up to) 4:1 color compression should keep things flowing.

Size: One of NVIDIA's most significant choices was to make NV30 a 0.13u (0.13 micron) part, unlike ATI's 0.15u R300. Along with the usual heat, power, and speed advantages of placing more transistors on less silicon, there is also the risk of 0.13u production challenges having a negative impact on delivery. But in the end, this could pay off handsomely, as even NVIDIA's competition has speculated that the demands DirectX9 specs put on hardware will favor or even require 0.13u technology. ▲

by Joan Wood

Shader Comparison

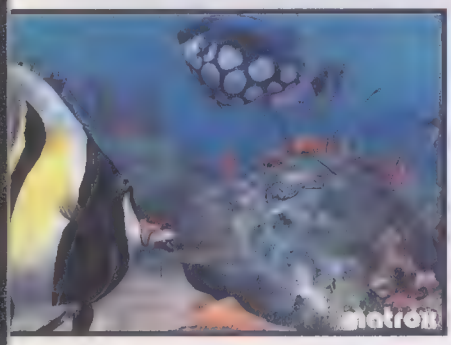
Based on numbers available at press time

	NV2x*	NV3x*	DX9**
Vertex Shaders	1.1	2.0+	2.0
Max Instructions	128	65,536	65,536
Max Static Instructions	128	1,024	256
Max Constants	96	256	256
Temporary Registers	12	32	32
Max Loops	0	65,536	256
Static Flow Control		yes	yes
Dynamic Flow Control		yes	yes
Pixel Shaders	1.1	2.0+	2.0
Texture Maps	4	16	16
Max Texture Instructions	4	1,024	32
Max Color Instructions	8	1,024	64
Max Temp. Storage	2	64	16
Data Type	fixed	float	float
Data Precision	12 bit	32 bit	128 bit

* Source: NVIDIA CineFX Architecture Tech Brief
** Source: DX9 presentation at Meltdown 2001

Matrox Parhelia-512

Parhelia-512
$399
Matrox
(514) 822-6000
www.matrox.com



Matrox' Parhelia technology (July *CPU*, page 24) wowed those who witnessed the visual results early on. It even won a "Best of Show" technology award at E3. But Matrox always stressed it was not trying to compete with the raw brute force of NVIDIA's GeForce4 Ti 4600. So where is a $400 board from Matrox really aiming? It's all about niche.

Despite its high price, benchmarks show the Parhelia lagging behind the GF4 Ti 4600. Parhelia is closer matched to a Ti 4200 (at half the price) using today's games. ATI's RADEON 8500 isn't as far ahead of Parhelia, but with the imminent R300, the gap will widen considerably. Parhelia's 3D gaming performance, somewhere between "adequate" and "decent," is far from earth-shattering.

Our review board features 128MB of 3.3ns Infineon DDR-SGRAM clocked at 275MHz (aka 550MHz) with the core GPU clock set to 220MHz. Core speed is limited by the chip's large 0.15-micron die size and 80 million transistors. Still, with four pixel pipelines (four texture units each) and pixel and vertex shaders, the board packs some beef. Though the fill rate of 880MPps (megapixels per second) lags behind the GF4Ti 4600's 1200MPps and even falls short of the GF3 Ti 500's 960MPps, memory bandwidth is another story. The Parhelia 128MB board's 17.6GBps worth of bandwidth is far ahead of the competition, including the GF4 Ti 4600's 10.4GBps. But NVIDIA and ATI use Z-buffer compression and occlusion culling techniques to get more efficiency than their memory bandwidth constraints would suggest. The Parhelia performance suffers from lack of culling, as it processes pixels you don't see or need.

The real strength of the Parhelia lies in its 10-bits/channel "gigacolor," surround gaming, hardware displacement mapping, and 16X fragment anti-aliasing (visually superior to super sampling) capabilities. Since the early days of 3dfx, I can't remember being as impressed by a demo as I was by Matrox's Reef demo, which literally blew my cotton socks off. Quake III running with said features looks incredible by comparison to other currently available hardware; it just runs slower. FAA truly takes the idea of smoothing jaggies to the next level. No technique from ATI or NVIDIA currently comes close in terms of visual quality. When enabling the Parhelia's 16-tap anisotropic filtering, the performance delta closes with NVIDIA's crop, but ATI's more intelligent method (it drops down to a lesser filtering technique when possible) still wins where performance penalty is concerned.

Matrox considers TripleHead surround gaming a front-running feature. Of course, you need a desk large enough to accommodate three monitors. You can run some games at 3,072 x 768 x 32 (three screens of 1,024 x 768 x 32), but the best trade-off comes at three screens of 800 x 600. Flight Sim and RTS/RPG (tool and map screens) buffs might really get a kick out of it. But try before you buy.

Under the right conditions for Parhelia (FAA, heavy use of quad texturing and pixel and vertex shaders), content is visually stunning. Productively speaking, a three-screen desktop enhances many work environments. In fact, though the 128MB board is aimed toward PC enthusiasts, Matrox sees its core platforms as the 2D Triple-Head work environment and workstations. It plans a 64MB board (about $300) for the 2D workstation market, and a higher clocked, more expensive 256MB version for 3D workstations. Support for content creation tools will be released on an app-by-app basis. The Parhelia 128MB ships with a 10-bits/channel color Photoshop plug-in, which will likely result in an artist stampede to get one.

If you want the fastest fps and trendiest card on the block and are prepared to spend $400, opt for GF4 Ti 4600. If you wait a bit longer, the R300 parts are on their way and are even faster. What about Parhelia? It's a top-quality chip that sports an impressive array of new features. If you are one who looks to Matrox for visual quality, this is by far the most impressive hardware the company has released. ▲

by Alex "Sharky" Ross

Parhelia Weighs In

	Parhelia-512	GF4 Ti 4600	GF4 Ti 4200	RADEON 8500
3DMark 2001 default	7035	11435	10953	8452
Serious Sam TSE 1024x768	54	80	71	59
Quake III 1,600 x 1,200	62	135	107	94
Jedi Knight II 1,024 x 768	71	104	95	59
Commanche 4 1,024 x 768	39	49	46	31

Tested on a WinXP Pro P4 2.53GHz

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

ATI Radeon 9000 Pro

Radeon 9000 Pro
$149
ATI
(905) 882-2600
www.ati.com

Power users are all atwitter over the release of ATI's newest and most powerful graphics card: the Radeon 9700. But ATI also released a less expensive board, the Radeon 9000 Pro, which provides a generous amount of horsepower for gamers, considering the card's price of only $149. The Radeon 9000 Pro rules the sub-$200 graphics card market, making NVIDIA GeForce4 MX cards look like slow, awkward teenage boys at a high school dance.

The Radeon 9000 Pro uses ATI's RV250 chip, and, unlike other sub-$200 video cards that shall remain nameless, offers full DirectX 8 support for games. The card has 64MB of DDR-SDRAM and a maximum resolution of 2,048 x 1,536. The refresh rates top out at 200Hz and start at 85Hz, which will provide a flicker-free screen regardless of the resolution you use. The 9000 Pro supports both OpenGL and DirectX.

The 9000 Pro's 3DMark2001SE score of 7,049 is well above average for a video card in this class, and the Radeon 9000 Pro outperformed most NVIDIA GeForce4 MX cards in our 3D tests. The card's Quake III frame rate at a resolution of 800 x 600 was a stellar 201.6fps, and at 1,024 x 768, the frame rate was 163.0fps. The frame rate dipped to 73.8fps when I increased the resolution to 1,600 x 1,200, but that's still not too shabby for a sub-$200 card.

I ran the Serious Sam time demos last, and the 9000 Pro posted better than average (for an "economy" card) frame rates in both of the demos. The card's frame rate in the Karnak demo was 54.3fps, and the 9000 Pro managed a frame rate of 63.7fps in the Metropolis demo.

If you're looking for an alternative to GeForce4 MX card, the 9000 Pro is it. Good power, good price, and all of the DX 8 bells and whistles. What more could you want for $150? ▲

by Michael Sweet

Lite-On 48X/12X/48X CD-RW

48X/12X/48X CD-RW
$119
Lite-On
(408) 935-5353
www.liteonit.com

Happy happy, joy joy. Lite-On beat its competitors to our door with the first 40X CD-RW drive we'd seen, and it has done it again with the first 48X drive to grace our testing labs. But was it the fastest burner I've ever seen? Well, wouldn't you like to know.

OK, yeah, it was. I was just messing with you.

After 48X-certified, Lite-On branded media arrived, we quickly got jiggy with it. In our 700MB CD-R test, the new Lite-On crushed its forerunners like Conan the Barbarian with a 2:57 (minutes:seconds) write time. It sped through a 427MB partial CD-R burn in 2:04, then slowed down a bit for our CD-RW and read rate tests. After all, it had just kicked rump where it counted, so I can't really fault it for taking it easier in the less crucial areas.

Starting off the list of its penultimate (but still top-tier) scores, there's the Lite-On's 8:06 burning time for a nearly full 639MB CD-RW. It netted a 5:38 time for a partial 427MB rewriteable disc. The drive maxed out at 6,868KBps as a CD reader, averaging 5,084KBps under CD Tach 2.52. Finally, its 80ms random access and 167ms full-stroke access times are about par among most modern CD-RW drives. Some are a little better but many are far worse.

Lite-On says this drive supports "all Win-based" OSes. It has a 2MB buffer. Hopefully, 48X media will be more common by the time you read this. It wasn't long ago that even 40X discs were as scarce as plutonium around here, although the RIAA seems to be regarding the CD-Rs as a greater threat than plutonium these days. This is a fast drive. Recommended. ▲

by Marty Sems

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

Canon EOS-D60

EOS-D60
$2,699
Canon
(800) 652-2666
(714) 438-3000
www.powershot.com

The spec sheet for the 6.3-megapixel Canon EOS-D60 is reminiscent of the Christmas list my brother made when he was 4: You wonder if the list will ever end.

Among the highlights of this SLR model are AE and FE lock, shutter priority, aperture priority, AE bracketing, automatic depth-of-field auto exposure, and shutter speeds from 1/4,000 second to 30 seconds. The camera's DSP processes images so quickly that you can take eight consecutive shots at 3fps.

The D60 bundles a Li-Ion rechargeable battery pack (about 490 shots per charge), dual-battery charger, power adapter, DC coupler, lithium backup battery, neck strap, and an eyecup eb, which you'll use when framing shots with the optical viewfinder. (The camera's LCD is only for menu and review functions, not recording.) Canon doesn't include a CompactFlash card or a lens (all Canon EOS lenses are compatible).

Canon loaned me a 16mm to 35mm f2.8 USM lens ($2,400) and a 380EX-10 external flash unit ($300). My test results reflect not only the performance of the D60 but also the lens. The lens seemed ill suited to the built-in flash, which created barrel shadows on the bottom of images. Using the optional 380EX-10 flash removed the shadows.

Full Auto mode images were a bit dark, but changing the settings produced some of the sharpest images I've seen. I took macro shots of flowers on a windy day, yet the pictures were so well focused that I could see tiny seeds, spider webs, and other very small details. Most impressive, though, was that no test images had any noise or chromatic aberrations.

With some effort, an amateur could use the D60; an experienced photographer should feel right at home. The nearly endless array of optional lenses, the advanced manual settings, and the mind-boggling 6-megapixel images make the D60 the best digital SLR I've seen to date. ▲

by Kylee Dickey

Minolta DiMAGE S404

DiMAGE S404
$499
Minolta
(877) 462-4464
(201) 825-4000
www.minoltausa.com

At first glance, the price of Minolta's DiMAGE S404 looks like a misprint. After all, no company can afford to package a 4-megapixel CCD with a 4X optical zoom lens for only $499, right? Surprisingly, Minolta does just that with this excellent digicam.

This is a tough camera, featuring a slick-looking aluminum body. In the box, you get a wimpy 16MB CompactFlash card and four even weenier AA batteries that will last for about an hour before surrendering. For my review, Minolta provided four NiMH cells and a charger. It takes a few hours to charge these batteries, but their immense power is well worth the wait.

The S404 takes both still shots and full motion video (complete with audio). You select options using the cyclical menu atop the camera or with the five-way controller and 1.8-inch monitor. Most options are easy to access, and there are dedicated buttons for the self-timer and EV functions.

Performance-wise, this is an impressive camera. There are virtually no shot-to-shot delays, even when you use the powerful flash. The only exception is when you shoot at maximum resolution (2,272 x 1,740) using Superfine compression; the S404 needs nearly 30 seconds to store such photos. Fear not, though: You can only store one of these beauties on the 16MB card, anyway.

Photo quality was about average. I saw some noticeable yellowing on indoor shots, and there were violet chromatic aberrations under fluorescent lights. On the whole, however, the S404's Auto mode did well, and Minolta provides so many manual functions (such as Color Saturation) you can use to improve your images that I can't list them all here.

Considering its spec sheet and performance, this camera is one heck of a value. It'll sate the appetites of both novices and advanced amateurs. ▲

by Nathan Chandler

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

WHAT'S *YOUR* BURNING DESIRE?

VIDEO

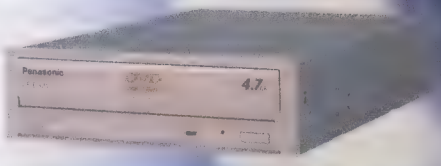
AUDIO

IMAGES

DATA

Whatever it is, chances are the Panasonic LF-D321U will satisfy it. That's because it burns DVDs using only DVD Forum approved formats like DVD-RAM and DVD-R. Only DVD Forum approved formats ensure information security and maximum compatibility between DVD players. On the Read side, it's just as flexible, because it reads virtually every DVD and CD format. So you get extreme compatibility with extreme storage capacity— up to 9.4 GB per disk! It's perfect for Video, Data and Imaging applications. Also included is a set of powerful software titles that gives you the ability to play, capture, edit and burn your Video files, as well as back-up your hard drive. So if you're looking for the hottest DVD Drive that gives you the power to burn and more, check out the Panasonic LF-D321U today.

DVD Burner
DVD-RAM/R DRIVE



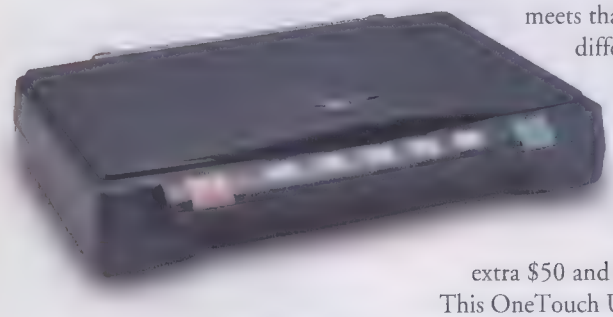
For more information, visit www.panasonic.com/storage

Panasonic

DVD RAM / R

DVD-CPU

Visioneer OneTouch 8900 USB



One Touch 8900 USB
$99
Visioneer
(888) 229-4172
(541) 884-5548
www.visioneer.com

Looking to purchase a scanner that wears a decent price tag and can hold its own? The Visioneer OneTouch 8900 USB meets that exact criteria. The only difference between the 8900 and its big brother, the 8920, is the ability to scan 35mm slides and negatives. If you're not interested in this ability, save yourself the extra $50 and go with the 8900.

This OneTouch USB impressed me. At a low $99, it offers more than decent specs and a software package that includes ScanSoft PaperPort Deluxe 7, Scansoft TextBridge Pro 9 OCR, and Adobe Photoshop LE 5.0. The lid is adjustable, and it felt secure.

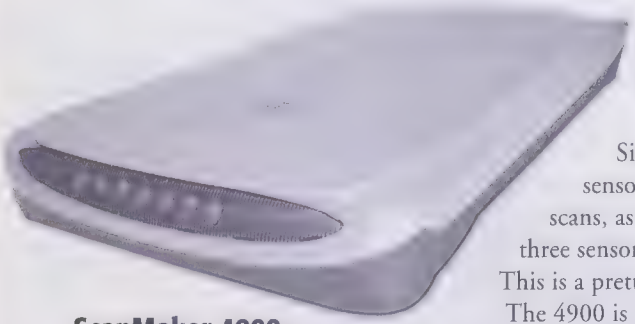
The 8900's maximum optical resolution is 1,200 x 4,800 dpi, which is more than adequate for most users. Scanning at 600dpi, small print on objects was precise and readable when I enlarged the image up to 52%. I tested six photos ranging from 150dpi to 1,200dpi, all with good results.

Scanning times averaged nine seconds at 150dpi and a little more than two minutes for five out of the six scans at 1,200dpi. That's not too shabby for a $99 scanner. The quick scan times are due partly to the 8900's FlashBack Bi-directional AutoScan Technology. It can perform an autocrop scan in just one pass where most scanners take two, speeding up the scan time.

For an economically priced scanner, the 8900 rates well. Scan times are more than acceptable for a scanner in this price range, and images are clear. I would have liked to see better image definition above 52%, but that might raise the scanner's price. ▲

by Mary Lafferty

Microtek ScanMaker 4900



ScanMaker 4900
$149.99
Microtek
(800) 654-4160
(310) 687-5800
www.microtekusa.com

When it comes to digital imaging products, Microtek is definitely among the leading manufacturers. Microtek proves this with each scanner it produces, and the tradition continues with the ScanMaker 4900. The 4900 comes with a Sigma-6 CCD that holds six sensors to boost accuracy in scans, as opposed to the usual three sensors in lower-priced scanners. This is a pretty good deal for $149.99.

The 4900 is sturdy and well-built, featuring a 3D expansion lid to scan larger objects. The scanner has seven Smart Touch buttons running across the front, including Cancel/Setup, Scan, Copy, Email, Text Scan (OCR), Scan To Web, and Custom. The inclusion of a 35mm Lightlid that lets you scan negatives and transparencies (and is very easy to install and uninstall) puts this scanner a step ahead of the competition.

We scanned three black-and-white photos that contained various shades of gray, and the scans came out distinct and clear. The three color photos we scanned came out clear and detailed, as well. Objects that appeared far-away in the scans were a little out of focus, but the quality wasn't too shabby for a lower-priced machine. The negative scans were a little grainy and lacked brightness, but for a feature added as a marketing tool, they weren't bad at all. Scan times averaged about a minute per scan at 600dpi, which is about average for this price range.

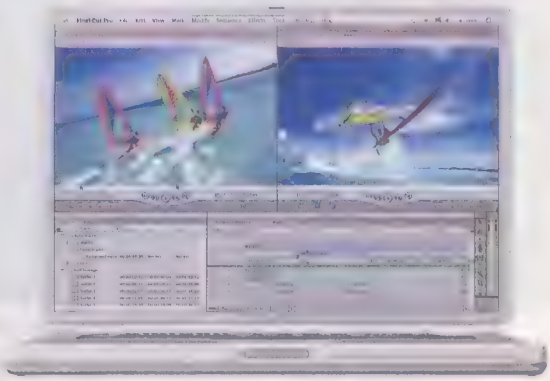
If you're looking for a decent scanner that isn't going to put a huge dent in your pocketbook, I would definitely recommend the ScanMaker 4900. With a resolution of 4,800 x 2,400 dpi and decent scan times, it is definitely one of the best scanners I've seen in this price range. ▲

by Mary Lafferty

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

Apple PowerBook G4 800MHz

Courtesy Of Apple



Microsoft might have a monopoly in the real world, but in the worlds created by television and movies, Apple is number one. Hollywood obviously loves the look of Apple's hardware (and who can blame it), but real-world users need more than just a pretty face. Enter Apple's new Titanium PowerBook G4.

Specifications. Our PowerBook review unit came with an 800MHz G4 processor (models with a 667MHz processor are also available). The G4 can't compete with the Pentium 4-M when it comes to clock speed, but Apple argues there's more to performance than clock speed. The G4 is the only processor to use L3 cache (1MB of it) to help increase performance. According to Apple, additional features, such as the G4's Velocity Engine and pre-emptive multitasking, give it an edge over Intel's mobile processors.

The high-end PowerBook ships with 512MB of PC133 SDRAM. Although slower than PC2100 DDR-SDRAM, Apple includes twice the RAM as most systems we've seen recently. The lower-end G4 model ships with 256MB of RAM, but both models are upgradeable to as much as 1GB. Our unit included a 40GB 4,200rpm hard drive. The new PowerBooks are also the only notebooks to include Gigabit Ethernet. A modem and an integrated AirPort card (Apple-speak for 802.11b) are also included.

The notebook's RADEON 7500 graphics chip drives the PowerBook's 1,280 x 854 wide-screen display and can power an external monitor. Combined with a slot-loading DVD/CD-RW combo drive, the chip and wide-screen display make the PowerBook an excellent movie machine.

Unix fans will enjoy the G4's OS X, which wraps a smooth graphical environment around a Unix base. You can even access a Unix command line if you feel the need.

Design. This latest G4 maintains the same sharp look of the older titanium PowerBooks. The silver titanium makes for a smart looking, well protected case, although I did notice that protection around the LCD was very weak. Nonetheless, the notebook's body was well protected.

Although the slot-loaded optical drive isn't as flexible as a modular drive, it does allow for a slimmer system. The PowerBook only measures 1 inch high x 13.4 inches wide x 9.5 inches deep. The added width leaves plenty of room for the keyboard and speakers (which are located on each side of the keyboard). The keyboard itself had a nice feel, and it was well laid out.

The PowerBook's resolution has improved over older models. Text, images, and video all looked sharp. The PowerBook had no problems playing back DVD movies, and the PowerBook's speakers were above average.

Instead of VGA-out, the PowerBook comes equipped with DVI-out for connecting to digital flat-panel monitors. An included DVI to VGA adapter lets you connect to more conventional CRT and flat-panel monitors.

By default, the PowerBook uses an external display as an extension of the PowerBook's desktop, letting you drag windows between the two displays. Monitor arrangement is highly configurable, and you can drag the application menu from one display to the other. For presentations, you can mirror the PowerBook's display on an external monitor.

We used an Apple Studio Display to test the PowerBook's video output. The Studio Display uses ADC (Apple Display Connector) to provide power and video over a single cable. To connect to the Studio Display, Apple sent us a DVI to ADC adapter. The adapter plugs into a USB port and the DVI port on the back of the PowerBook. The USB connection lets you use the USB ports on the Studio Display.

Performance. Apple claims this system is competitive with 1.6GHz Pentium 4-M processors. We can't verify that claim because our benchmark software is incompatible with Apple hardware. I can say, however, that I had no problems with the system's perceived performance. Applications, and the system in general, seemed to respond quickly.

Final word. At $3,199, this G4 is expensive, but it's a sharp-looking, nicely designed notebook. Movie fans will appreciate the slot-loaded display, plus the new features on the PowerBook (DVI out and Gigabit Ethernet). ▲

by Chad Denton

G4 PowerBook 800MHz

$3,199
Apple
(800) 538-9696
(408) 996-1010
www.apple.com

CPU CPU CPU CPU

Features

Processor: 800MHz PowerPC G4

RAM: 512MB

Hard Drive: 40GB

Optical Drive: DVD/CD-RW

Connectivity: Gigabit Ethernet, AirPort (802.11b), Modem

Display: 15.2 inch

Weight: 5.4

Final Word: Expensive, but nicely designed, and includes some nice extras, such as Gigabit Ethernet and DVI out, I've yet to see on other notebooks.

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

HP Pavilion f50

Pavilion f50
$649
Hewlett-Packard
(888) 999-4747
(650) 857-1501
www.hp.com

So you're looking at a picture of a monitor on a manufacturer's Web site or in a newspaper ad, but something seems amiss. The brilliant full-color image plastered on the monitor looks beautifully surreal, too good to be true. Well, often it is. Marketing folks find the prettiest sunset-on-the-beach image available and superimpose it on the photograph of the monitor. HP's new Pavilion f50, however, depicts images so beautifully they look superimposed.

In some respects, the Pavilion f50 is a standard 15-inch LCD; it has the usual 1,024 x 768 maximum resolution, it weighs the typical 10.6 pounds (including the base), and it has a modicum of on-screen controls. On the other hand, the Pavilion f50 has a nice 75Hz refresh rate (many LCDs stop at 60Hz) and accepts dual (analog and digital) input. Thanks to the monitor's digital (DVI-D) port and imaging precision, it also comes with a higher-than-usual price tag.

I tested the Pavilion f50 at its maximum resolution and refresh rate and with a 9300K-color temperature. During diagnostic tests, the monitor provided good uniformity, no defocusing, no stuck pixels, and an on-key balance of light to dark. Color combinations all looked good. Focus and resolution matrices showed off the monitor's ability to remain sharp under trying circumstances. And although other LCDs tend to falter a bit when faced with video bandwidth and brightness test screens (thin black and white lines will look too gray), the Pavilion f50 hung in there (black and white maintained integrity without shifting to gray).

Practical tests revealed more awesome imaging. High-resolution images looked clear, bright, and richly colored; application colors looked just like the manufacturer intended; and text was razor sharp at every size. If you can do without a larger screen, the Pavilion f50 will handle it all. ▲

by Cal Clinchard

Western Digital Caviar WD800JB 80GB Special Edition

Caviar WD800JB 80GB Special Edition
$189
Western Digital
(800) 275-4932
(949) 672-7000
www.westerndigital.com

Western Digital hit upon something when it added unusually large 8MB cache buffers to a couple of its top 7,200rpm drives. As more users are fooling around with audio and video files these days, not to mention playing bigger games and taking higher-resolution digital photos, EIDE hard drives can often show a performance improvement with big buffers normally reserved for SCSI drives.

All was good, and Western Digital was enjoying the accolades (and profit margins) from its premium desktop drives. However, not everyone wanted to shell out the cash for a 100GB or 120GB Special Edition drive, so the company answered the call for an 80GB version.

The WD800JB hung tough in most of our speed tests, rivaling its 120GB big brother for the No. 1 slot on our current Top 5 List. In fact, I let the 120GB version win due to capacity. After a few tussles with WinXP's DMA settings, we got good scores from a 1.8GHz P4 system with 512MB PC800 Rambus memory and WinXP Pro. This two-platter Caviar hit a superb 40.5MBps average read rate (49.3MBps maximum) and a 24.1MBps average write rate (35.0MBps maximum), with a low 13ms random access time. Under Winbench99, this little hottie rang up an 8,540KBps Business Disk rating and a 25,700KBps High-End Disk score.

The only horseflies in the WD800JB's wine glass are its low nonoperating shock tolerance (just 200G for a 2ms shock, compared to the competition's 300G to 350G) and relatively high noise levels (35dB A average idle, 37dB A to 39dB A average seek). Of course, if you're a careful installer, and you have noisy fans in your rig anyway, these drawbacks shouldn't dissuade you from getting this drive. ▲

by Marty Sems

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

Allen Concepts KEYKatcher-PRO

Perhaps you've heard of Allen Concepts' KEYKatcher device, a little adapter that fits between the PS/2 connector of your keyboard and your PC's PS/2 port. The KEYKatcher captures your every keystroke sans special software and is, by the nature of its secretively small size, useful for monitoring the typing and Web surfing habits of children and highly intelligent pets.

The KEYKatcher-PRO (let's call it "PRO"), however, is the full-sized keyboard version. Anyone can use the PRO but, as its name implies, it's the professional manifestation of the KEYKatcher concept. A shiny blue logo right on the keyboard declares that the KEYKatcher Computer Monitoring System is at work.

The PRO is a standard 104-key 'board with three additional power management keys and is boringly beige. Because the PRO has built-in KEYKatcher capabilities, it has a slight leg up over the separate mini KEYKatcher device, which you can easily unplug unless you attach the included tamper-resistant seal. To thwart the PRO, you must unplug it and supply a separate keyboard.

Open a word processing or notepad program, type a password, and the PRO starts logging. Follow the same process, except type 1 to select the View Memory option, and see almost everything that's been typed since you activated keystroke logging. Save it as any other text, type 2 to initiate the Erase Memory option, type 8 to exit, and the PRO is ready to log some more.

The PRO can search for a string of characters or words and includes a NETPatrol feature for finding URLs and email addresses quickly. For logging, the PRO does it, well, like a pro. ▲

by Cal Clinchard

KEYKatcher-PRO
$129
Allen Concepts
(480) 659-8076
www.keykatcher.com

CPU CPU CPU CPU

Envision EN-910e

Almost every product has its good points and its bad points, but Envision's EN-910e CRT monitor had the kind of good-and-bad tug-of-war going on that made me keep changing my mind about the monitor's score. Great color, I thought. 4 CPUs! It's not as sharp as possible. 1.5. But it has a garage sale price tag. 3.5. You get the idea. The EN-910e might turn your crank or turn you off.

Our lab folks plugged in the monitor and connected it to an IBM system running WinXP and containing an ATI All-In-Wonder 64MB Radeon 8500 DV Edition video card. For testing, I used a 1,024 x 768 resolution at 75Hz with a color temperature of 9300K.

I liked the EN-910e overall and think its combination of strong points and its $199 price tag make it a great deal, so let's dispense with its bad points first. Although the monitor has a nice, sharp 0.25mm dot pitch, its video bandwidth index is slightly low at 82, with 100 being ideal. The screen that tests for halos revealed a little softness where sharpness is desired, and in the white-level regulation test screen, the thinnest black-and-white lines weren't as sharp as possible and therefore tended toward gray.

Color is the EN-910e's strong suit; the monitor provided radiant colors when faced with color scales, color tracking screens, and even the otherwise boring color saturation scales. It also fared better than most CRTs during tests for color combination (all combos looked great) and color registration, where red and blue synced up just as well as red and green (that's a very good thing). The EN-910e also delivered sharp text and excellent light-dark balance.

For those looking for an inexpensive replacement for a burnt out old CRT, multiple monitors for office use, or great color, the EN-910e performs extremely well. ▲

by Cal Clinchard

EN-910e
$199
Envision
(888) 838-6388
www.envisionmonitor.com

CPU CPU CPU

CPU Ranking: 0 = Absolutely Worthless CPU CPU 2.5 = Absolutely Average CPU CPU CPU CPU CPU 5 = Absolutely Perfect

iBUYPOWER Night Dreamer XP

Night Dreamer XP
$1,799 (without monitor)
iBUYPOWER
(888) 462-3899
(626) 281-8262
www.ibuypower.com

CPU CPU CPU CPU

Features

Processor: Athlon XP 2200+

RAM: 512MB DDR-SDRAM

Hard Drive: 80GB

Optical Drive: CD-RW; DVD-ROM

Connectivity: Modem; 10/100 Ethernet

Video Card: NVIDIA GeForce4 Ti 4600

Chassis: Midtower

Monitor: N/A

System Use: Entertainment

Final Word: Excellent performance at low price.

The highest of the high-end system makers generally revel in bringing the latest and greatest video capabilities to 3D gaming aficionados, the stuff that makes power users drool uncontrollably. The problem is there's a largely untapped category of high-performance gaming systems in the $1,500 to $2,500 price range, leaving gamers on tight budgets to build their own or save up until they can afford to spend three to five grand on a holy grail gaming PC.

This is where iBUYPOWER comes in, with a variety of affordable systems that provide excellent gaming power. I had the pleasure of reviewing the latest Night Dreamer XP in a configuration that's set for release in August.

Specifications. You can configure your own Night Dreamer XP on the iBUYPOWER Web site, but the system I reviewed came with an AMD Athlon XP 2200+ processor, which has a 1.76GHz clock speed but performs roughly as well as a 2.2GHz Pentium 4. It has an OK 133MHz bus speed and an OK 256KB L2 cache, but a decent 512MB of DDR-SDRAM.

For a hard drive, iBUYPOWER stuck with a single 80GB IBM DeskStar. The system has Artec optical drives: The WRA-WA8, a fast CD-RW that writes at 32X, rewrites at 12X, and reads at 48X, and the DHI-G40, a DVD-ROM drive that reads at 16X. The software bundle is small but includes Ahead Nero for burning CDs and PowerDVD for playing DVDs.

In the Night Dreamer XP, multimedia is king. The system has an NVIDIA GeForce4 Ti 4600 video card with 128MB of DDR-SDRAM, a Creative Sound Blaster Live 5.1 Surround Sound audio card, and a six-piece Creative Inspire 5.1 speaker set. For input, there's a black Mitsuko multimedia keyboard with hotkeys galore and a silver Microsoft IntelliMouse Explorer. My test unit included a ViewSonic E90fb monitor, a nice-looking 19-inch CRT that's sold separately for $269.

The system has an Intel V.92 HaM FaxVoice modem, an Intel PRO/100 Ethernet adapter, one parallel port, one serial port, four USB 1.1 ports, and two USB 2.0 ports. It comes loaded with WinXP Professional and Remote Assistance software. For service, iBUYPOWER provides a 3-year limited warranty, first-year on-site service, and lifetime toll-free phone support.

Design. I admire iBUYPOWER's ability to cut corners without dulling the effect you normally get from a high-performance system. Most folks don't need, for example, multiple high-capacity hard drives, FireWire, and a huge software bundle. Those are nice, but if you want to lower costs, they aren't necessary.

The tower, speakers, and keyboard are black. The windowed, well-ventilated tower has blue neon inside and two side case fans below the window. The case is innovative but less expensive than those with automotive paint jobs.

On the downside, the case design makes upgrading difficult. The motherboard accommodates a whopping 3GB of memory, and there are six available 5.25-inch bays and two free PCI slots. The power cables that connect to the side case fans only let you open the door to a certain degree; you have to unplug the power cables or work in extremely cramped circumstances to upgrade memory or drives. Additionally, the USB/serial port plate blocks the free PCI slots, so adding extra cards would be a challenge.

Performance. The Night Dreamer XP fared pretty well during the SYSmark2002 benchmarks. It scored 153 in Office Productivity (which is OK) and 225 in Internet Content Creation (which is great) for an Overall rating of 186. It performed well for the PCMark2002 Pro benchmarks, earning a 5,317 CPU Score, a 3,249 Memory Score, and a 959 HDD Score.

Last, but hardly least, the system soared during 3D tests and snared a huge 10,565 3DMark2001 score. The GeForce4 Ti video cards have made 10K-plus 3DMark2001 benchmarks a reality, and the Night Dreamer XP takes advantage of this.

I played a few rounds of Quake III, went chapter jumping through "The Matrix" on DVD, and played some audio CD tracks. The system handled every audiovisual task flawlessly. The speakers cranked out crisp, powerful sound.

Final word. Forgive me for gushing, but I've rarely seen a system of this caliber for a very reasonable price. The Night Dreamer XP isn't perfect, but it's definitely worth a look. ▲

by Cal Clinchard

CPU Ranking: 0 = Absolutely Worthless CPU CPU 2.5 = Absolutely Average CPU CPU CPU CPU CPU 5 = Absolutely Perfect

Xoxide LL-60 Warrior

The PC case mod scene has really hit big-time. You don't need to be the sort who has a machine shop, drag races in Bakersfield, and tarts up your car with neon to get into it. Any online PC retailer worth its weight in colored, rounded cables stocks many brand-name cases that are starting points for newcomers looking to get into the scene. You get a lightweight, distinct-looking case that encloses all of that expensive, hot-running hardware as a bonus. Xoxide takes this concept further by premodding cases for you. That way you don't need to get your hands dirty cutting out windows, etc.

Xoxide's top-of-the-line choice is based on the much-loved (and abused), all-aluminum Lian Li PC-60 case, dubbed the LL-60 Warrior. It comes precut with side window for your light show (add another $39 for a cold cathode light) and is extremely upgrade-friendly. With no sharp edges, tool-less assembly via thumbscrews, and a pull-out motherboard tray, it's roomy too. And not central London bed-sit roomy, either. I'm talking eight 3.5-inch bedrooms for your entire family of hard drives. There are also four master suite 5.25-inch bedrooms for those bulkier media drives. The front bezel comes with four USB ports concealed behind a latched door (standard these days).

Just as the car stereo scene can get outrageous with oversized subwoofers, the same can be said for PC fans. Xoxide has loaded this one with a total of four 80mm intake fans along with two exhaust fans. Two side-mounted Sunon fans bring cooler air into the case as do the twin front-mounted Adda fans, which double as a hard drive cooler (groovy). The top sports a mammoth 120mm Dynatron fan for your exhaust needs. In sum, there's enough decent circulation to keep a couple of PCs in temperate conditions, let alone enough for some serious overclocking.

Add the price of a decent 400W PSU (power supply unit), and you're talking $400 including delivery, which sounds like enough to make you question just how decadent the art form has become. Go on, you know you want one. . . . ▲

by Alex "Sharky" Ross

LL-60 Warrior
$249.99
Xoxide
(866) 496-9433
www.xoxide.com

Lava Kazan USB 2.0 Hard Drive Enclosure

You can treat your system to a new hard drive, but where ya gonna put the old one? Sure, it doesn't cost anything to keep the old drive as a second internal unit, but maybe you really don't want another heat-producing device in your already-cramped case. You could spend $73 to make that old drive an external unit.

Lava's Kazan USB 2.0 drive enclosure kit contains all you need to convert an EIDE drive to a sleek external model. Like Lava's FireDrive, the Kazan has a solid-feeling, ventilated case with a drive activity LED. Both types of Lava enclosure come with an AC power adapter and an appropriate data cable.

USB 2.0 is fast enough at 60MBps to support all but the latest EIDE drives' data transfer speeds, minus some overhead. However, USB 2.0 devices are only as good as their implementations. The 40-line ATA/33 cable inside the Kazan was not a welcome sight. You need an 80-line ATA/66/100/133 cable to enjoy the top speeds of today's drives without an avoidable bottleneck. Of course, drives that are a few years old or older should be able to give their all in the Kazan enclosure, less that bit of overhead I mentioned earlier.

Lava provided a USB 2.0 PCI adapter, which we used to try an 80GB Western Digital Caviar WD800JB and then an 80GB Seagate Barracuda ATA IV in the Kazan. As did Lava's FireDrive, the Kazan enclosure curtailed the drives' top speeds, returning a max read rate of 11.5MBps for the Caviar and 11.6MBps for the Barracuda. And no, installing an ATA/66 cable between the drive and the Kazan didn't help. ▲

by Marty Sems

Kazan USB 2.0 Hard Drive Enclosure
$73 ESP
Lava
(800) 241-5282 (United States)
011 + (416) 674-5942 (Canada)
www.lavalink.com

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

Gateway 700XL

700XL
$2,999 (without monitor)
Gateway
(800) 846-4208
(605) 232-2000
www.gateway.com

CPU CPU CPU CPU CPU

Features

Processor: 2.53GHz Pentium 4

RAM: 1GB RDRAM PC800

Hard Drive: 120GB

Optical Drive: 40X12X48X CD-RW

Connectivity: V.92 56Kbps modem; 10/100 Ethernet

Chassis: Midtower

System Use: Entertainment

Final Word: "Entertainment" is down for the System Use, but really this is a great system for anybody.

Gateway's latest 700XL is easily one of the most powerful PCs on the market. It costs less than comparable high-end models from other manufacturers because it doesn't have any fancy paintwork or case mods, and its low price tag arguably makes the 700XL the best bargain in the high-performance realm.

Specifications. Our review unit included an Intel 82801BA chipset with a 2.53GHz P4, a 533MHz FSB, and 512KB L2 cache. The system also has 1GB of RDRAM PC800, with room for more.

I was impressed with Gateway's selection of drives. The system has a roomy 120GB Western Digital Caviar Ultra ATA hard drive, which is a nice 7,200rpm model. For a CD drive, Gateway went with Lite-On's LTR-401255 CD-RW. I've been consistently pleased with the performance Lite-On drives provide, and this one tested well. It writes at 40X, rewrites at 12X, and reads at 48X. With a nod to storage mongers and video enthusiasts, Gateway included a Matshita DVD-R/RAM drive (more on that shortly).

The 700XL fills just about anybody's personal and professional computing needs. It's loaded with WinXP Home Edition, and its large-capacity hard drive is prime for office-related data filing and graphic design work. The system is also ideal for gamers, thanks to the NVIDIA GeForce 4 Ti 4600 4X AGP video card with 128MB of DDR-SDRAM and a Creative Audigy sound card. With high-end system makers typically opting for Klipsch speaker systems, I found it refreshing to see a five-piece Boston Acoustics set here.

The 700XL has a 56Kbps V.92 modem and an Intel PRO/100 Ethernet adapter for versatile connectivity. It also comes with a multimedia keyboard and optical scroll mouse, both Gateway branded. For ports, the 700XL has one serial, one parallel, one FireWire, and six USB (two USB 2.0 ports in front and two USB 1.1 ports and two USB 2.0 ports in back).

Design. You can open the midtower case by pushing a button and sliding the case outward and upward. There's plenty of room inside, reducing the sweat involved in upgrading. The hard drive bays face outward for easy access, and none of the bays require tools for removing drives.

The motherboard has five PCI slots, two of which are available for upgrades. With two unoccupied memory slots, you can double the memory to 2GB. There are five 3.5-inch bays and three 5.25-inch bays in all; that leaves two 3.5-inch bays and one 5.25-inch bay free. Although the 700XL doesn't use the most exciting case design possible, I appreciated the plentiful ports, especially the speedy FireWire and USB 2.0 ports.

Performance. There are high-end systems that fare *slightly* better on some of the benchmarks, but the 700XL is hands-down the highest-performing system I've seen for this price.

The system earned some of the highest SYSmark2002 scores ever. The overall SYSmark2002 score was 251, the result of a 331 score for Internet Content Creation and 190 for Office Productivity. The system also performed well when the lab folks ran MadOnion's PCMark2002. The results were a 6,153 CPU score, a 5,890 Memory score, and a 1,114 HDD score. The icing on the cake was a super-high 3DMark2001 score of 11,146.

I stretched the video card's limits a little by playing a few rounds of Quake III. At an 800 x 600 resolution, the frame rate was 258.8fps; at 1,024 x 768, the maximum frame rate was 260.9fps; and at 1,280 x 1,024, it hit 252.7fps.

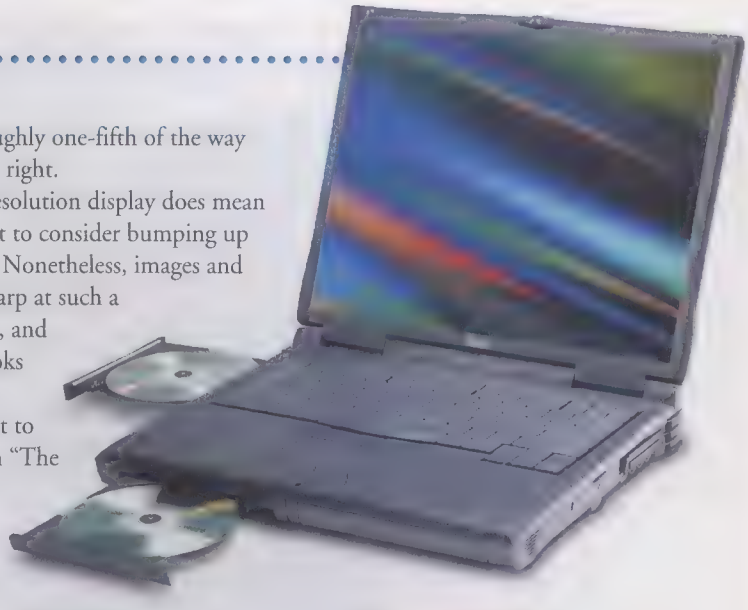
The CD-RW drive played audio CDs flawlessly and burned a 54-minute audio CD in 4:39 (minutes:seconds). The DVD-R/RAM drive played DVD movies without a hitch, but it's questionable whether the format will survive the onslaught of the competing DVD+R/RW format. It took roughly 30 minutes to format a 4.7GB DVD-RAM, and 1:43 (hours:minutes) to copy 3GB worth of files from hard drive to DVD-RAM.

Final word. I thoroughly enjoyed testing the 700XL, including viewing its gorgeous 18-inch LCD (Gateway model FPD1810, sold separately for $980). The system accommodates games, multimedia fun, and serious business tasks simultaneously. If you can afford it, it's worth it. ▲

by Cal Clinchard

CPU Ranking: 0 = Absolutely Worthless CPU CPU 2.5 = Absolutely Average CPU CPU CPU CPU CPU 5 = Absolutely Perfect

Dell Latitude C840



Because Dell considers its Latitude PCs to be a business line, it's pretty unlikely we'll see the Dell kid putting the hard sell on some company CEO stumbling around a department store. Thank God for that. The Latitude C840 is a more serious machine, but as I think you'll see, there's a playful side to this Latitude, as well.

Specifications. With a 1.8GHz Intel Pentium 4-M processor and 256MB of PC2100 DDR-SDRAM, our C840 is up to any business task you want to throw its way. The 40GB hard drive should provide plenty of room for reports, presentations, spreadsheets, and other files business professionals are rumored to squirrel away on their PCs. Our unit came with an 8X DVD-ROM drive, but a CD-RW or combo drive would probably be more productive for the typical business user. These options are available when you order from Dell.

Like the Inspiron 8200, the C840 features a fixed optical drive and a modular bay for adding another type of optical drive or a floppy drive. You could order, for instance, a system with a CD-RW modular drive and a DVD-ROM drive. This setup would let you copy files directly from one CD-ROM to another without having to save information to the system's hard drive.

Our unit didn't feature any wireless networking options, but again, those options are available if you're interested. Our system did arrive with Ethernet for connecting to a corporate network and a modem for dialing in while you're on the road.

The 15-inch UXGA display (1,600 x 1,200) allows for high-resolution presentations and gives you plenty of real estate when working within Excel. The NVIDIA GeForce4 440 Go graphics chip, however, will try to lure you away from your work for a good round of Jedi Knight 2. Be strong.

Design. Let's face it: No self-respecting businessperson is going to walk into a meeting with an orange notebook under his arm. (Just because you were up late the night before playing GTA3 is no reason to look like you're a slacker.) The C840's navy blue finish looks sharp and promises not to embarrass you.

The C840 not only looks good, but it's fairly durable, as well. Granted, it isn't going to survive if you drop it off a bridge, but it should stand up to the regular perils of travel. Protection around the LCD is adequate, although there seems to be a weak spot roughly one-fifth of the way across from the right.

That high-resolution display does mean you might want to consider bumping up font sizes a bit. Nonetheless, images and text are very sharp at such a high resolution, and DVD video looks equally good. When you want to relax and watch "The Matrix" yet again, the C840 will provide solid playback with no annoying skips or pauses. Like other notebooks, however, the C840's speaker system detracts from the movie-watching experience a bit. Although the speakers have decent volume, they lack a strong range, making them sound thin and tinny.

If you have a good thing, you might as well stick with it. Dell uses the same keyboard in the C840 as it uses in the Inspiron 8200. The keyboard is well laid out and comfortable to type on. Like most Dell systems, the C840 includes both a TrackPoint and a touch pad.

Performance. Somehow it seems like Dell is always capable of squeezing a few extra points out of SYSmark2002. In this case, it managed a 116 in Office Productivity, a 241 in Internet Content Creation, and a 167 Overall SYSmark2002 rating. The Overall score is just six points better than IBM's ThinkPad T30 and 13 points better than the Inspiron 8200 with a 1.7GHz Pentium 4-M processor.

Oddly enough, however, the IBM bested the C840 in PCMark2002 benchmarks (which are not application-based like SYSmark2002). The T30 managed a better CPU Score (4376 to 4338), a better Memory Score (3753 to 3652), and a better HDD Score (533 to 441).

Final word. The Latitude C840 is a first-class business machine. Although IBM's ThinkPad T30 seems to have an advantage in PCMark-2002 benchmarks, the C840 maintains a performance advantage when it comes to running applications. ▲

by Chad Denton

Latitude C840

$2,896
Dell
(800) 999-3355
(512) 338-4400
www.dell.com

Features

Processor: 1.8GHz Intel Pentium 4-M

RAM: 256MB/1024MB

Display: 15-inch TFT

Dimensions (inches): 1.78 x 13.03 x 10.87

Weight (pounds): 7.4

Hard Drive: 40GB

Optical Drive: 8X DVD-ROM

Connectivity: Modem; Ethernet

Final Word: Plenty of features and performance make C840 a top-notch business PC.

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

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ORIGINAL MUSIC
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by Anand Lal Shimpi

ATI Takes The Crown

It has been an uphill battle for ATI over these past couple of years; while enjoying success on the mobile end, ATI has seen much of its desktop market share erode at the hands of NVIDIA. The release of the Radeon 8500 was probably the most frustrating, as a mere driver release prevented it from outperforming the GeForce3, and the $199 GeForce4 Ti 4200 offered an untouchable level of performance. This time around, things have changed.

The elusive next-generation GPU from ATI has been talked about under the codename R300 for months now, and it's finally available. The R300 GPU is a very large 0.15-micron chip composed of close to 110M transistors that is significantly faster than even the fastest GeForce4 Ti 4600. The first product from ATI that uses the R300 is the Radeon 9700 which, by the time of publication, should be available for $399. The R300 is also the first DirectX 9-compliant chip to hit the consumer market and thus offers a whole new slew of features to end users and developers. I'll leave that focus for another day, however as you're probably more concerned with what makes the R300 tick.

Borrowing a page from NVIDIA's Crossbar memory architecture, the R300 features four independently load-balanced memory controllers. Each memory controller has a 64-bit channel to its DDR memory devices, giving the R300 a 256-bit memory bus, much like the Matrox Parhelia. The R300's memory controllers are said to support the DDR-II memory standard. At the time of writing, ATI hadn't finalized its memory clocks but were targeting 300MHz+.

When NVIDIA introduced the GeForce4, it brought the Xbox's dual vertex shader pipelines to the PC; with the R300, ATI is pushing the envelope even further by including a total of four vertex shader pipelines. These vertex shader pipelines then feed the eight pixel pipelines (up from four in the GeForce4 and Radeon 8500) which allows the Radeon 9700 to achieve extremely high fillrates. Once again, at the time of writing, ATI had not finalized their core clocks but were targeting 300MHz+. For a ~110M transistor, 0.15-micron chip, that is quite impressive. For comparison, both 3DLabs and Matrox use fewer transistors on similar processes and can only reach speeds of 220 to 250MHz.

With the R300, ATI also introduces its third generation HyperZ technology, called HyperZ III. HyperZ III simply improves on the original three components of HyperZ—Hierarchical Z, Z Compression and Fast Z Clear—in order to make more efficient use of the memory bandwidth available to the chip. You can read my article at AnandTech.com for more information on how HyperZ works.

The R300 GPU finally supports both supersampling and multisampling anti-aliasing; ATI will probably only make multisampling visible through the driver. The combination of HyperZ III, an incredible amount of memory bandwidth and a lot of fillrate power to back it up makes the R300 the first GPU to be able to realistically run at higher resolutions with both AA and anisotropic filtering enabled.

As far as performance is concerned, the R300-powered Radeon 9700 is significantly faster than the GeForce4 Ti 4600 across the board. This is the first time that ATI has been able to put out such a powerful chip and maintain such a large lead over NVIDIA's flagship.

The battle isn't over yet; if you're buying a new graphics card today and you want the fastest out there, then the Radeon 9700 is perfect, but there's always something lurking around the corner. NVIDIA's answer to ATI's R300 has been delayed until November but it should be faster, at least according to preliminary specs of the NV30. And although ATI does have a 0.13-micron version of the R300 chip in the works, I wouldn't expect to see that until early next year. ■

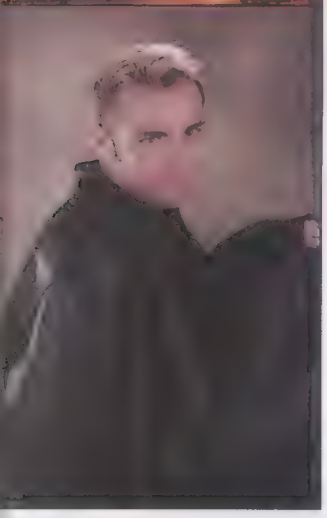
Talk tech to Anand@cpumag.com.

R300 vs. NV25	ATI R300 / Radeon 9700	NVIDIA NV25 / GeForce4
Manufacturing Process	0.15-micron	0.15-micron
Transistor Count	100 to 110M	63M
Pixel Pipelines	8	4
Texture Units per Pipeline	2	2
Vertex Shader Units	4	2
Core Clock	325MHz (Estimated)	300MHz (Ti 4600)
Memory Controller(s)	4 x 64-bit	4 x 32-bit
Memory Clock	315MHz (Estimated)	325MHz
Memory Bandwidth	20GBps (Estimated)	10.4GBps
DirectX Support	DX9	DX8

Anand Lal Shimpi has turned a fledgling personal page on GeoCities.com into one of the world's most visited and trusted PC hardware sites. Anand started his site in 1997 at just 14 years old and has since been featured in USA Today, *CBS' 48 Hours and* Fortune. *His site—www.anandtech.com—receives more than 55 million page views and is read by more than 2 million readers per month.*

by Alex "Sharky" Ross

Uncle Sam Wants Gamers



Disrupting Reuters' newswire with a cheery Christmas greeting at age six, Alex "Sharky" Ross became an avid computer user/abuser, eventually founding popular hardware testing/review Web site SharkyExtreme.com. Exposing shoddy manufacturing practices and rubbish-spouting marketing weasels while championing innovative products, illuminating new technology, and pioneering real-world testing methods was just a front for playing with the best toys. The site acquired, he left in 2001. A London native and London School of Economics graduate, Alex currently swims in Silicon Valley.

Summer is here, which means it's like a toasty day in the Sahara, and apparently not just in California, either. There are no waves for surfing, I already got nabbed speeding (see wife's column), and it's too hot to move furniture (even with those naff moving men widgets sold on TV). So all my usual extra-curricular activities are on hiatus.

Luckily, with air-conditioning set to full throttle, I've been having quite a lot of fun making good use of my P4 2.53GHz and GF4Ti 4600. Having finished Soldier of Fortune II: Double Helix, I was left rather disappointed. Sure the graphics were top-notch (best use of the Quake III engine I've seen), but after awhile, it became apparent that the single-player game was dragging on and on with repetitive enemies, shoddy AI, and poor level design. Multiplayer was nothing short of ordinary, so no luck there either. Poo! With Unreal Tournament II not due out until late Q3, and a PC version of Halo not slated until next year, what's a gung-ho gamer (no longer hooked on Counter-Strike) stuck in the middle of summer supposed to do? Join the Army! OK . . . I can be Private Pyle (even though I'm a Brit): I'll do my bit for this country.

In case you were outside enjoying food, beer, and fireworks on July 4, you might not have realized that the U.S. Army released a beta slice (dubbed Recon) of its online, team-based, tactical 3-D first-person shooter, America's Army: Operations. Apparently some 400,000 people downloaded it on the first day alone. At this rate, it could well turn out to be the next Counter-Strike. Operations is free and, contrary to popular belief, you don't actually have to sign up for the Army to play, even though it's supposed to be a pseudo-recruitment tool. I wonder how many of us 25- to 35-year-old gaming geeks the Army will actually want. But back to the point: I was one of the many who downloaded Recon. It even uses the most current version of the Unreal Engine, and being a Brit (for some reason July 4 isn't particularly popular where I'm from), I had nothing better to do. The project cost close to $7 million (pat yourself on the back, Mr. & Mrs. U.S. Tax Payer), which to game development is probably what "Men in Black II" is to movies, aka loadsa money.

I picked myself a name (Mini Cooper) and pword and went straight in and then proceeded to auto-install some downloads, like the multiplayer server browser software. Before you can actually head out, guns blazing Tarantino-style, you need to learn some skills and then complete MOUT (Military Operations in Urban Training) missions, complete with cardboard pop-ups. It's worth the work needed to become a certified Sniper Rifleman, Marksman, and so forth. Now you're ready to head out. Weapons or classes are chosen at the start, and players are divided into two teams either defending or assaulting one another. For reasons of political correctness, neither team plays as the terrorists, but, oddly enough, the two teams see one another as terrorists. With support for up to 32 players, things get messy quick, but due to ROE (Rules of Engagement), any soldiers who continually misbehave (shooting civilians or your own troops, etc.) will get docked and eventually sent to the virtual stockade.

The beta itself will continue to be updated with more missions and patches, but the final version will have up to 20 missions (Recon already has 10) and real-world weapons, including M249 automatic, M16A2 assault rifle with optional M203 (AK74 with optional GP-30), M4 carbine (AK47), M24 and M82 sniper rifles, M67 frag grenades, and M83 smoke grenades. The game features incredibly detailed indoor environments, as well as expansive outdoor levels, which run smoothly, all of which is necessary for a game of this type, of course.

So go on, head over to www.americasarmy.com because your country needs you. See you online, soldiers. I'll bring the M16, you bring smoke grenades, and we'll have some fun "Army" style. Too bad my government at home hasn't picked up on this idea and made a realistic first-person Bobby (Police) Sim, where you can run around the streets of London with a truncheon (stick). ■

Email your antitank busting shells to Sharky@cpumag.com

by Kyle Bennett

Time For A Major Upgrade?

Kyle Bennett is editor-in-chief of HardOCP.com, one of the largest and most outspoken PC-enthusiast sites on the Web. HardOCP.com is geared toward users with a passion for PCs and those who want to get cutting-edge performance from their systems. Beware, though, Kyle is known for his strong opinions and stating them in a no-nonsense manner while delivering some of the most in-depth reviews and PC hardware news on the 'Net.

The time to upgrade is coming, but wait a month or two before making the jump, especially if you're looking at fully rebuilding your current system or pulling off what equates to being a major overhaul. The last quarter of this year is going to heat up as the Christmas buying season approaches.

Mainboards and chipsets. We've already tested and published preliminary scores at HardOCP.com that showcase Intel's dual-channel DDR266 chipset, codenamed Granite Bay. Even though it's still very much in a beta state in terms of both hardware and software, it shows that it has a lot of promise, as it turned in quite impressive benchmarks, showing it to be equal to if not better than top-shelf PC1066 RDRAM boxes. While Intel wants to push this Pentium 4 chipset into the workstation sector, it's quite apparent now that companies such as ASUS will be building retail mainboards for the DIY crowd with Granite Bay. Official dual-channel DDR333 won't be realized till Intel kicks off its "Springdale" chipset next year, and it's yet to be seen if any company will build a mainboard on the Granite Bay chipset that will allow us to overclock the memory bus.

Also, the Pentium 4 is being shown off by VIA, who has now pulled back from selling its much awaited P4X333 chipset in favor of the P4X400 that will support single-channel DDR at 400MHz. I expect the Granite Bay chipset will outperform the P4X400 in similar configurations, and certain 266MHz DDR-RAM is going to be less expensive than DDR400. As of this writing, DDR prices have been on the rise for several weeks, rising as much at 40% in cost. While VIA is still tightlipped about the chipset, they also have a dual-channel DDR chipset in the works to support the DDR333 standard, the P4X600. We're hoping it makes it before the end of the year. VIA has proven to be the master of building performance memory controllers, so I think its dual-channel DDR board has the potential of being a real screamer.

I have some real reservations about building a top-end Athlon system at the moment, especially with the AMD Hammer CPUs being launched around the turn of the year. The Athlon's bus is still locked at 266MHz, crippling any advanced DDR subsystem. If synchronous hardcore bus overclocking is your thing, then you can make your Athlon open up and utilize all that new memory bandwidth that is out there.

The VIA KT400 and NVIDIA nForce2 chipsets are close to being on retailers' shelves and will surely be here before the holidays. Both these chipsets give the Athlon CPU even more bandwidth than what's currently available. The KT400 will surely be an enthusiast's chipset that will allow for all sorts of overclocking and tweaking with inexpensive Thoroughbred CPUs. Just be prepared to cool them off.

Video cards. ATI has now launched the Radeon 9700 based on the R300 chipset, and it should be for sale very soon. (9700 features and architecture are revealed in "Anand's Corner" on page 34. I suggest reading up on it.) If you have the cash and are a gamer, you want to buy this card. This will be THE CARD TO HAVE, till something better comes along of course. If you don't have the cash and have to upgrade now, go NVIDIA Ti 4200 or ATI 8500. Both are great VidCards that will leave some money in your pocket so you can save up for the Radeon 9700 you deserve.

This will be THE CARD TO HAVE . . .

My pick. Get a dual-channel DDR mainboard with good overclocking features, either VIA or Intel. Match that with either a 1.6A, 1.8A, or 2.26GHz Intel Pentium 4 CPU, as all three have already proven to be great OCers. Then back that with solid, tweakable DDR-RAM from the likes of Corsair Micro, as it will allow very aggressive memory timings. Finish off the jewel with ATI's Radeon 9700, and you will have a gaming box that will leave you with phenomenal benchmark scores, an open upgrade path up to a possible 4GHz, and a box that we already know excels at running DOOM. Then you can go brag—a lot. ■

Talk with Kyle at kyle@cpumag.com.

SALT LAKE 2002 GAMES SUPPLIER

when you wake up, will you tap your potential?

or tap the snooze button?

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PowerBar Be great.

Each month we ask a staff writer to take on our publication editor in a challenge to build the best PC for a certain price. Because our writers don't want to lose their jobs, they always accept this challenge willingly. Tempers will flare. Tools will fly. But only one will prevail.

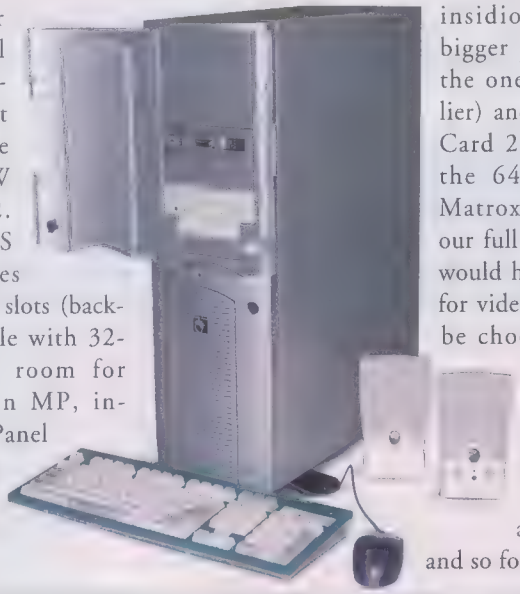
This month the challenge is to build the
Most Expandable System Under $800.

Samit

There are so many ways to "expand" your PC, but in my mind, it all starts with the case. After a lengthy pause at the $340+ Lian Li PC-76 Full-Tower with 20 bays, I followed my instincts to the silver monstrosity you see below and to the right: the Chieftec Matrix MA-01SLD. I also looked hard at some other very nice cases before I settled on the Matrix because it provides the best bang for the buck (and it doesn't look too shabby, either).

Dimensions on this case are 27 inches high x 8 inches wide x 19 inches deep, and it features 14 drive bays (six 5.25-inch, two 3.5-inch externals, and six 3.5-inch internal hard drive bays). The case is compatible with PSII, PSII redundant, or standard redundant PSUs and has plenty of room for optional cooling fans (five 80mm cooling fans and one 92mm cooling fan). This model includes the side-cooling fan with a cool-looking speaker grill on the exterior of the case.

If money were no object, I would have dropped in a nice overkill PSU, such as the Enermax EG651P-VE FMA 550W or Turbo-Cool 600W ATX. Instead, I went with a humble P4-ready 350W PSU for $52. The dualie ASUS mobo features two 64-bit PCI slots (backward-compatible with 32-bit PCI), has room for another Athlon MP, includes ASUS iPanel support, and can fit up to 3.5GB of registered RAM.



I dropped in two add-in PCI cards: a 4-port USB 2.0 card along with a 3-port FireWire card. The Enermax Multi-function Transfer Panel took up one 5.25-inch bay on the front and plugs through the PC to both USB 1.1 ports and a FireWire port. The ATI RADEON 7000 card supports a multimonitor desktop and features an SVIDEO TV-Out jack.

What would I have done if we'd had a slightly higher budget? Well, I would have gotten insidious, very insidious, and added a bigger power supply (like the one I mentioned earlier) and an Adaptec SCSI Card 29160 to drop into the 64-bit PCI slot. A Matrox Parhelia-512 (see our full review on page 19) would have been my choice for video. But beggars can't be choosers, and I could live with the current configuration for a secondary workhorse (game server, VCD creation, file server, and so forth) PC. ▲

Component	Model	Price
Case	Chieftec Matrix MA-01SLD Full Tower Case w/80mm Side Panel Cooling Fan and 14 drive bays[1]	$133.99
Motherboard	ASUS A7M266-D (Dual Socket A) with 4-port USB 2.0 PCI card[4]	$199
Processor	AMD Athlon MP1200 (Palomino)[2]	$79
Memory	Crucial 256MB 184-pin DIMM, Registered, DDR2100[6] *	$80.99
Hard Drive	Maxtor 60GB 7,200rpm[5] *	$129.98
Video Card	ATI RADEON 7000 VE 32MB with DVI/TV-Out; HydraVision support (OEM)[2]	$49
Sound Card	Onboard C-Media 8738 Audio Controller with 6-channel integrated sound	N/A
Network Card	ASUS PCI L3C920 (included with mobo)	N/A
Modem	Not on my watch, bub	N/A
DVD-ROM	N/A	N/A
CD-RW	Artec 40X12X48X[1]	$59.99
Diskette	Samsung 1.44 Floppy Drive[3]	$9.60
Speakers	Harman/Kardon HK19.5 Powered Satellite Speakers[1]	$6
Mouse	KEIO Precision Optical Mouse PS/2[1]	$8
Keyboard	Links KB121 Translucent Blue Spill Resistant PS/2 Keyboard[1]	$3
Operating System	Red Hat 7.3 (Downloaded to three CD-Rs)	N/A
Software	Nero 5 and bundled mobo packages	N/A
Miscellaneous	Enermax FW110 Multifunction Transfer Panel (5.25-inch bay)[2]	$21
	ThermalTake Volcano II Heat Sink and Dual Ball Bearing CPU Fan[2]	$5.50
	CHP FireWire IEEE1394 3-port PCI Card[2]	$15
	Think Box Thinking Head Case Badge[1]	$1.99
	Extra Power Cord	$1
	Heralchi HEC-350LD-T 350W P4-ready power supply	$52
Subtotal		$855.04
Shipping		$50.53
Tax		$4.26
Rebates/Coupons		-$75
Total		$834.83

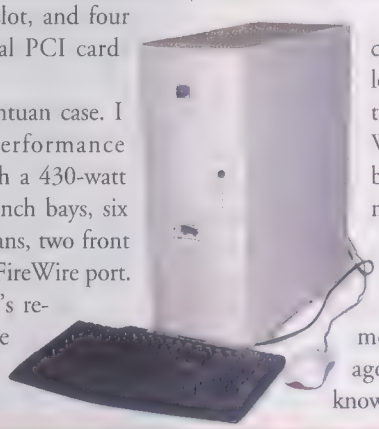
Purchased From:
1 Directron.com
2 Newegg.com
3 DIT Corp
4 nexthardwareshop.com
5 Staples.com
6 Crucial.com
* Items with Rebate/Coupon

Dana

My mission, which I chose to accept, was to build the most expandable PC under $800, monitor not included. To me, expandable means future capabilities. If you're building a PC today, it should meet the needs of tomorrow. So I loaded up my system with lots of slots, ports, and options.

I started by looking for the perfect motherboard and found it in the ASUS P4S533 bundle from J&N Computer Services. Why did I go with a bundle? Because not only did I get the motherboard, but in one purchase I also got a Pentium 4 1.6GHz processor, 128MB of DDR-RAM PC2700 memory, a heat sink, and a fan. The processor has a 533MHz front-side bus with a processor socket that supports speeds of 2.4GHz and beyond. In addition, you can upgrade this motherboard to 3GB of RAM, and it includes six PCI slots, one AGP 4X slot, and four USB ports. An additional PCI card offers two USB ports.

Next I needed a gargantuan case. I landed on the Antec Performance PLUS1080 full tower with a 430-watt power supply, four 5.25-inch bays, six 3.5-inch bays, three case fans, two front USB ports, and one front FireWire port. To expand on my system's resume, I added an ATI True RADEON 8500 64MB video card. Not only does this card have TV-out and the capability to run dual monitors, but it also supports both CRTs and flat panels. I also slid in a Creative Labs SoundBlaster Live! 5.1 PCI sound card.



I went with a Zonet ZEN3200 10/100 PCI network card instead of a modem, and because I only needed to load my operating system, I opted for just a 52X CD-ROM drive. For the sake of operability, I purchased a mouse and keyboard. I made sure that they both hooked up by USB and much to my pleasure, I found a keyboard with two USB ports. To make the USB pot even bigger, I added in a SIIG 5-Port USB PCI card, bringing my total of possible USB ports to 15.

With my mission successfully completed, I looked into my crystal ball to see what the future holds. What's that I see? Could it be the Insidious One melting into the floor in awe at the sight of my offering? What's that I hear? Could it possibly be the moans that accompany the agony of defeat? You never know, it could happen. ▲

Component	Model	Price
Case	Barebones System (including power supply) Antec Chassis FT ATX12V 430W P/S TruePwr 4 5.25 6 3.5 BGE[7]	$118.85
Motherboard	ASUS P4S533 Motherboard Bundle[6]	$344
Processor	Pentium 4 1.6GHz (included with motherboard)	N/A
Memory	128MB DDR-RAM PC2700 (included with motherboard)	N/A
Hard Drive	Maxtor 20GB 5,400rpm[2]	$48
Video Card	ATI True RADEON 8500 64MB DDR DVI/CRT (OEM)[5]	$91
Sound Card	Creative Labs Soundblaster Live! 5.1 (OEM)[3]	$34.99
Network Card	Zonet 10/100 Ethernet PCI Adapter[3]	$6.95
Modem	N/A	N/A
CD-ROM	52X LG IDE INT (3)	$28
Diskette	1.44MB floppy disk drive (used)[4]	$2.50
Mouse	Microsoft Optical Mouse[1]	$14.97
Keyboard	IBM Internet Multi-Media[1]	$29.99
Operating System	Linux Mandrake 8.1 free download	N/A
Miscellaneous	SIIG 5-Port USB 2.0 PCI Card (1) *	$39.99
Subtotal		$759.24
Shipping		$36.89
Tax		$10.07
Rebates		-$10
Total		$796.20

Purchased From
1 Best Buy
2 Upgradesolution.com
3 DIT Corp
4 Neon Blue Media
5 dljsystem.com
6 jncs.com
7 pagecomputers.com
*$10 Rebate

And The Winner Is

Blaine "Growing Pains" Kirk Cameron Has Nothing On These Two" Flamig

What is it about a really big box that makes kids so absurdly loopy? I distinctly remember as a wee lad watching my pop unpack something really big from a damn huge box, just waiting until I could flop around in my own cardboard abode. Strangely, the same urge nearly overcame me standing next to Samit's case. Had I not been afraid of getting lost and never getting out, I would have crawled in. Seriously, I've lived in smaller apartments, my man. But I digress. There's judging to do, so let's get to it.

First, let's review a bit, class: Most exandable system *UNDER* $800. Samit, can you see the chalkboard OK, fella? No matter; you fail, and by default, you lose. Your case could comfortably house a family of wild grizzlies, but you crossed the forbidden price line. Dana, I dub you reigning champ. (With the 38 bucks more that Samit spent than you, I don't doubt you could have broken some kind of USB record.) It's a shame, really, because this was shaping up as a good battle, and it would have been tough picking a winner. I'm not sold on the Linux/hardware upgrade choices, but the expandability of both cases is almost silly. Outside of Samit's SCSI idea, there isn't much to want for. Overall, I favor Samit's CD-RW, dualie, and RAM but Dana's keyboard and CPU. Next time, Samit, don't put more on your plate than you can pay for.

Swappin' Parts

There's A Transformation Taking Place

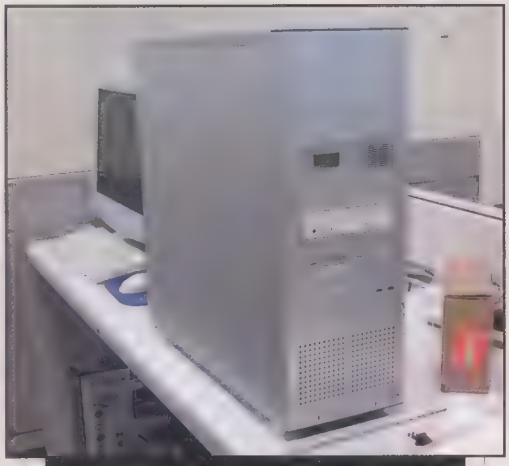
Each month in "Swappin' Parts," a Computer Power User *writer upgrades one out-of-date component in our test machine, MERLE (Mediocre Electronic Refurbished Low-end Equipment). When we're finished, we will have transformed MERLE from a silicon trash can into a powerful system we'd be proud to put in our own homes. To date, we've updated MERLE's CPU, sound card, speakers, video card, RAM, optical drive, case, PSU, monitor, motherboard, and cooling system. Whew.*

Our task this month was to give MERLE a power makeover. We decided to cut a rectangular bay window in MERLE's side panel and add cold cathode neon lighting to show off the components we've upgraded the past few months. We also agreed that a paint job was definitely in order. After considering a few options (including a cheesy, flaming hot rod getup that would surely have gotten under our editor's skin), we went with a biohazard look. We also found some cool round safety-yellow ATA cables and biohazard symbol fan grills to complement the design.

Cal: Disembodied MERLE

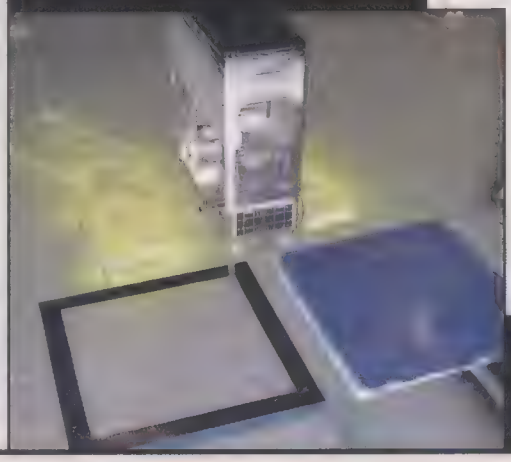
I took one last look at the premod MERLE before grabbing a Philips screwdriver, some antistatic mats, and a printout of the motherboard layout to begin dissecting MERLE. I cut his power, unplugged him, removed the side case covers, and placed MERLE side-down on a table.

Disassembly was a quick, easy chore. I unplugged the power supply and all the cables from the motherboard. On the motherboard printout, I noted the placement of power LED, hard drive LED, power switch, reset switch, and speaker connections with the motherboard's case pins. I jotted down some miscellaneous notes to make the post-makeover reassembly move along swiftly.



Not suspecting the carnage we're about to inflict on his brushed-aluminum Lian Li case, MERLE poses for one last photo.

MERLE shows his vulnerable side.



Halfway through his makeover, MERLE had already sucked up six cans of spray paint.

I disengaged MERLE's temp monitor's octopus-like heat-sensor cables and removed the monitor from its 5.25-inch bay. This cleared the way for clutter-free disassembly. I removed the remaining drives and FireWire and USB adapters, placing the components and screws in a cool, dry room. Finally, I removed the video card and motherboard and sandwiched them between antistatic mats to keep them safe.

Michael: Cutting

We decided to give MERLE a huge window to show off his pretty inside components, as well as his interior paint scheme. The first step was to cut a hole in MERLE's aluminum side panel. I had a Dremel rotary tool and a jigsaw at my disposal for this. I tried the Dremel first, cutting the panel pretty easily. However, the #409 cutting wheels either wore down quickly or broke, so I switched to the jigsaw, which was much better. The jigsaw easily ripped through MERLE's skin, and I had the hole cut in a few minutes.

MERLE already has plenty of fans, so we didn't need to add another one. However, we did have two fan grills, so I cut out two of MERLE's existing fan grills and replaced them with ours.

Finally, I had to cut a hole in the back of MERLE's case for the light kit's rocker switch. There wasn't much empty space on the case's back, but there were two more fan grills in the upper-left corner, which was the perfect spot for the rocker switch. I used the Dremel to

bore a hole in the center of one of the fan grills, which took awhile because stainless steel isn't the easiest material for a Dremel to cut through. Once done, MERLE was ready for Modification: Stage Two.

Cal: A New Coat Of Paint

To further MERLE's biohazard look, we decided on three paint colors, including dark blue for the inside, safety yellow for the front, and a blue/purple combination for the top and side panels. I had taken the case apart as completely as possible, but it took yards of 3M 2-inch masking tape to cover the LEDs, power switch, USB access door, and chassis frame to prepare the top and front for spray painting. I would have preferred to remove the top, but it was secured with rivets. The side panels and bay covers, of course, required less detailed masking. I roughed up the surfaces with fine-grain sandpaper, shook the spray paint, and began painting.

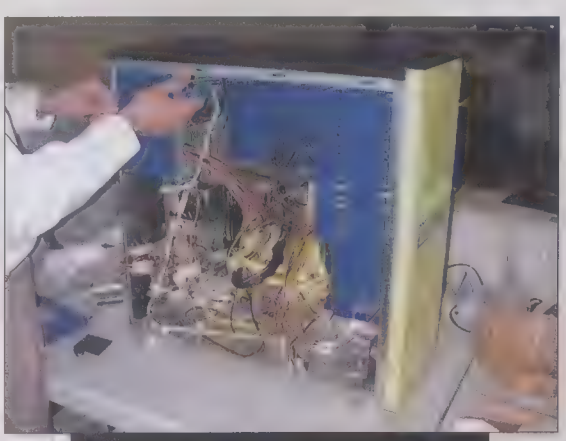
I used safety yellow Rustoleum Professional High Performance Enamel for the front panel and drive bay covers. It took about 90 minutes to mask and five coats of paint to eliminate the grayish hue that showed through the first four coats. The hard drive and CD drive had beige plastic bezels, and because I couldn't remove them completely, I painted them with Testors model paint and a brush so as to not risk damaging them with spray paint. The temp monitor bezel already had a nice chrome look, so I left it alone.

For MERLE's insides, I used standard deep-blue Krylon spray paint designed for metal, plastic, and other surfaces. The dry time for the Krylon and Rustoleum paints were impressively short. For the rest, I used the blue/purple version of Krylon's Mystique Color2Color kit, a three-step process involving a black base coat, multiple blue/purple coats, and a clear coat. The coats dried quickly at first (about 20 minutes, as advertised), but took a few minutes longer with each successive coat.

Michael: Acrylic

The new color scheme made MERLE look sharp. Once the paint was dry, I was ready to add the acrylic window to the left-side panel. I had a 24-inch x 24-inch acrylic sheet to work with, which I trimmed to 19.625 inches high x 20.125 inches wide. The window was a full inch wider than the panel cutout on all sides, leaving plenty of room to attach the window to the case panel.

There are several ways to fasten a window to a case panel. Many modders use window molding strips. You can also rivet the window to the panel or even use double-sided foam mounting tape. I decided on Heavy Duty Welder adhesive. I roughed up the inside of the case panel around the window cutout with sandpaper and squirted a thin stream of adhesive around the edges. I placed the window into position, pushing firmly. The adhesive was squishy for several minutes, but once it dried (24 hours later), the window was firmly and permanently fused to the case panel.



Finishing touches involved installing a cool cathode light and gaining control over MERLE's gangly cables.

A dozen Dremel bits after the fact, we caught MERLE showing off his new fan grills and interior lighting.

Cal: Reconstituted MERLE

I reassembled MERLE in the reverse order I took him apart. The paint didn't travel into any screw holes or other places it shouldn't go, so there were no reassembly problems. I replaced the old ATA cables with the new, safety-yellow ones. The newly windowed side cover slid perfectly into place, and the cuts Michael made for the hazard symbol fan grills worked as planned. Fortunately, there were no surprises. I removed the side cover for Michael to install the neon lighting.

Michael: Lights

The lighting mod was the easiest to make. I popped the rocker switch into position in the back of MERLE's case. The light and inverter included Velcro strips, so attaching these took little time. There was plenty of room for the light's inverter (a small circuit board) under the case's top panel. We decided the light looked best inside the back edge of the case, and I could position it there without using the light's Velcro strips. I connected the light's wires to the rocker switch and MERLE's power supply, and we were ready to go.

Back In Action

MERLE was eager to show off his cool new look when we were done. Our staff oohed and ahhed over the paint scheme and big window, and the soft-blue glow from the light kit illuminated the motherboard nicely. This upgrade was challenging at times, but fun, and we proved that two regular guys with more tools than sense could make a PC look truly unique.

(For additional photos of this mod, go to www.smartcomputing.com/cpumag/sep02/merle.) CPU

by Michael Sweet & Cal Clinchard

X-ray Vision: Cg Is Now Playing

Movie special effects! Real-time computer graphics rendering! They're on the ultimate collision course in Cg! Cg has the reviewers raving: "I give it four stars, two thumbs up, and a full tub of popcorn . . . with extra butter!" Don't miss Cg, appearing soon in gaming software near you!

OK, so NVIDIA's June release of its high-level graphics programming language, Cg, didn't receive the hype of a summer blockbuster such as "Men In Black II," but maybe it should have. If Cg lives up to its promise, it will greatly increase the speed with which movie-like effects will begin appearing in gaming software.

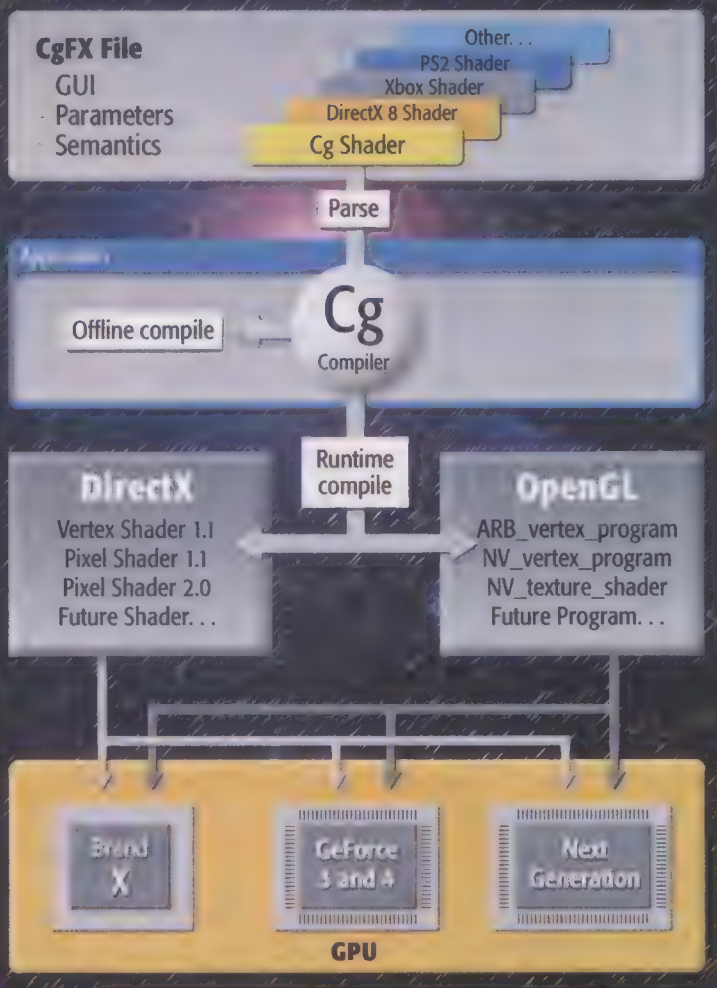
C For Graphics

The introduction of the C and C++ programming languages in the 1970s helped spark the widespread availability of applications for the CPU. NVIDIA hopes Cg (short for C for graphics) can provide the same sort of boost to applications created for the GPU. Developers should be able to use Cg to create effects in gaming software that will eventually rival effects you see on the movie screen. The use of Cg should make shader technology, used extensively in gaming software, more accessible to digital artists with limited programming skills.

Cg will work with both OpenGL and DirectX 8 and beyond. NVIDIA, which worked closely with Microsoft in creating Cg, developed the high-level language to layer on top of both types of API.

Put Cg To Work

Cg should offer several benefits to developers, including:



The Cg Compiler

A Cg-enabled FX file contains the information necessary to render a shader (which is the set of parameters needed to implement a visual effect on a set of pixels or vertices). The information in the FX file could include information aimed at several types of platforms or brands of GPUs. For example, you could have an FX file containing shaders written directly in Cg, in DirectX 8.0, and in OpenGL 1.4. Regardless of how many different types of shaders an FX file contains, the Cg compiler can parse the file.

The Cg compiler can work offline or in runtime, creating the types of shaders needed by the particular GPU in use. (Runtime refers to the compiler's ability to target the shaders directly to the type of hardware in use.) The Cg compiler also can make use of supplementary information in the FX file to create specific GUI environments, vertex information, and particular types of textures, as required by the shader.

The Cg compiler not only is backward compatible with older types of technologies and GPUs, but it will also work with next-generation technologies.

Independence. Game developers using Cg can worry less about having to create different commands to match different hardware platforms. Games written in Cg typically are platform-independent.

Longevity. Cg games should have a much longer shelf life than other games. Because the Cg compiler can work with future versions of GPUs and other types of hardware, Cg games can take advantage of new hardware features as they become available.

Sharing. Because of the ability of Cg to work across different platforms, developers can share Cg code for different projects. Once a shader is written, developers can apply it to several different gaming projects.

Cool effects. Some potential gaming software effects available through Cg include motion blur, procedural wood and marble surfaces, realistic skin and hair, reflective metals, and realistic vegetation.

Keep It Real

Some industry analysts have avoided the Cg bandwagon. The chief complaint about Cg concerns its perceived preference to NVIDIA products and hardware. Some analysts think Cg is wholly unnecessary. They say incorporating C or C++ to handle the features that Cg provides would work just as well.

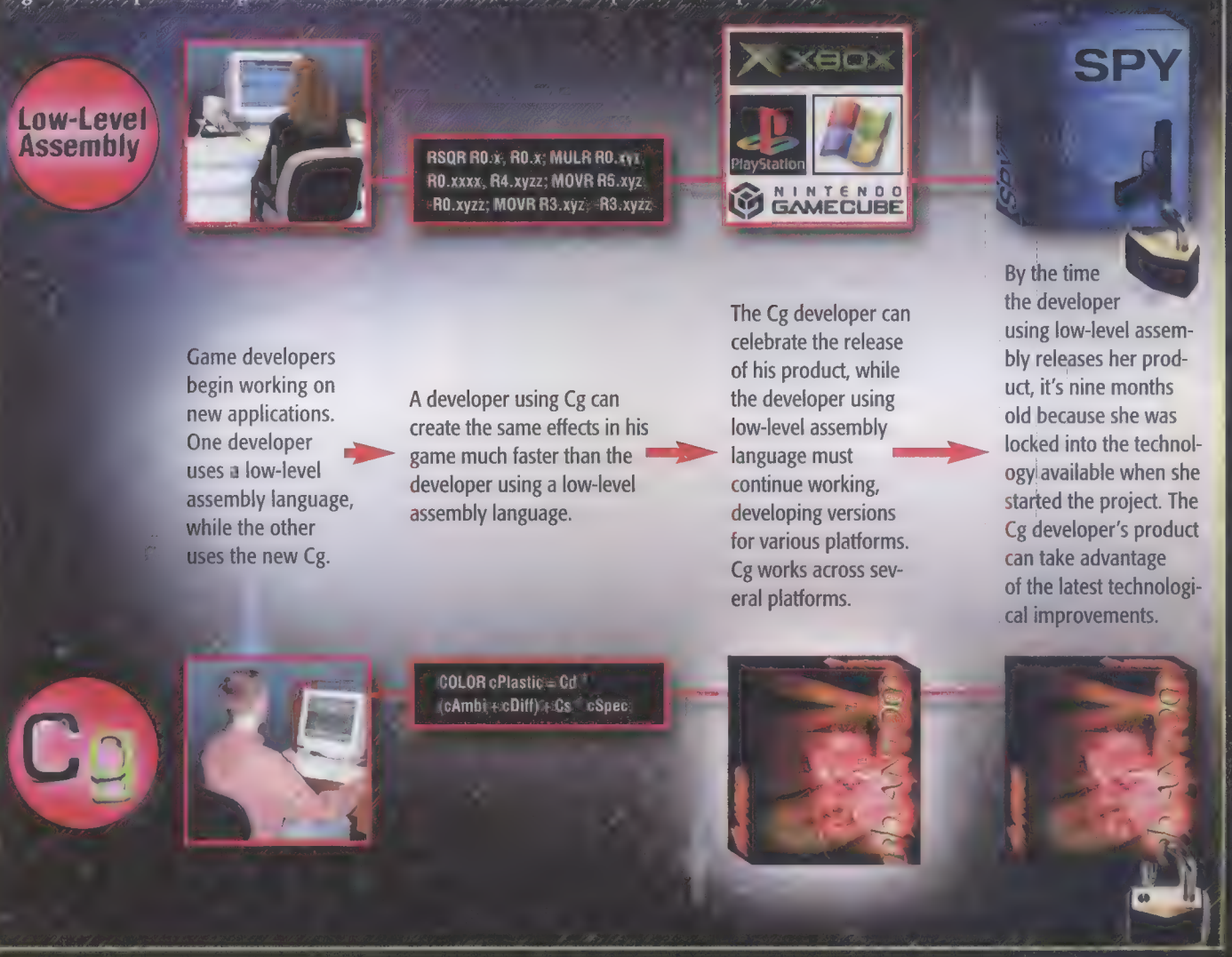
Still, there's plenty of hope that Cg will give game developers the ability to spend less time wrestling with programming syntax and more time creating impressive effects. The early reviews of Cg generally have been favorable; now we'll have to see whether it can live up to the hype and deliver at the box office . . . or at least on the screen of your gaming device. CPU

by Kyle Schurman

See www.smartcomputing.com/cpumag/sep02/cg for more Cg graphics.

Working At The Speed Of Cg

Cg lets developers create game effects much faster and with more platform compatibility.



Graphics & Design: Carrie Benes & Ned Day

Carnivore

In The FBI We Trust?

As American citizens prepare for the one-year observance of the 9/11 terror attacks against New York City and Washington, D.C., two feelings probably will be prevalent.

First, most people will experience an overwhelming sense of grief, remembering the more than 3,000 lives lost in the attacks. Second, though, most will be wondering how the U.S. government and law enforcement agencies are working to prevent additional attacks.

The FBI is one of several federal agencies with a renewed focus to battle terrorism in its many forms. One thing the FBI is using to try to prevent terror attacks is a software tool that existed well before Sept. 11, 2001: Carnivore. Briefly, Carnivore is a program that can monitor certain Web sites, networks, and email messages for criminal or terrorist activities or content.

The Meaty Details

First, let's make this clear: The FBI isn't releasing tons of public documents detailing Carnivore's source codes. After all, the FBI doesn't want to give the bad guys enough information to let them construct a blueprint for blocking Carnivore and other tools. However, based on some of the technologies on which Carnivore is built and based on some documents the FBI has released concerning Carnivore, we can reconstruct a reasonable idea of how Carnivore works.

Carnivore is a piece of software that can copy and then reconstruct data that passes through a network, including Web postings, Web pages, email messages, and file downloads. For example, the FBI might use Carnivore to capture a copy of an email message as it travels from a computer through an ISP's network. If Carnivore does its job properly, the sender and the recipient would never know the detection software captured the email message. FBI officials have described Carnivore as a software tool that hunts down and chews up data . . . but only the data the FBI has legal jurisdiction to obtain. (In an attempt to decrease the public's apprehension over the Carnivore system and the images the system's name might call up, the FBI has officially renamed the system DSC1000. However, the name Carnivore has continued to stick among members of the public and the media.)

Most analysts think the FBI placed Carnivore into service in June 1999. Carnivore actually is part of a larger software system, often called DragonWare Suite by those working with it inside the FBI. (Most people outside the FBI still refer to the overall DragonWare Suite package as Carnivore.) Carnivore is the portion of DragonWare Suite that actually captures the bits of data as they move across the network of the ISP being monitored. The captured data usually is stored for further analysis later.

Information about the remainder of the DragonWare Suite is a little sketchy, but many analysts believe two other parts exist. A tool called Packeteer reassembles the packets Carnivore captures, creating readable Web pages, email messages, and other data. And a tool called Coolminer performs the analysis of the captured data, looking for key phrases or other information.

Packet Sniffing

Carnivore is essentially packet-sniffing technology, which has existed for several years. In its original form, a packet sniffer continually monitors data moving across a network and runs tests on the network, helping a system administrator track down any problems.

Because packet sniffers already monitor the network traffic, it didn't take much of an adjustment to rework them to begin capturing data as they monitored the network. In most network configurations,

The History Of Carnivore

The FBI's use of email and Internet monitoring technology began in earnest in the mid-1990s and continues today.

- **Mid-1990s.** FBI begins using its first online surveillance software, believed to be a commercially available product called Etherpeek. (The FBI has never released data about Etherpeek.)
- **February 1997.** FBI begins using second-generation surveillance software, called Omnivore. Omnivore works a lot like Carnivore, attaching to an ISP network to capture copies of particular email messages.
- **June 1999.** FBI begins using third-generation surveillance software called Carnivore. Carnivore attaches to an ISP network to capture and copy email messages, offering improved filtering over Omnivore and the ability to re-create Web pages that a suspect was viewing and other Internet data. Carnivore runs on a Windows 2000 or NT computer.
- **April 2000.** An FBI memo, later obtained by EPIC (Electronic Privacy Information Center), shows a glitch in Carnivore may have harmed an investigation into an associate of Osama bin Laden.
- **July 2000.** After a lawsuit filed by EPIC, the FBI begins releasing documents detailing the existence of Carnivore. This represents the first public proof of Carnivore.
- **November 2000.** In response to a U.S. Justice Department request, the Illinois Institute of Technology releases a report after analyzing Carnivore. The institute says Carnivore, when used properly, does its intended job of monitoring a suspect's email while ignoring email messages from other customers of the suspect's ISP.
- **February 2001.** The FBI, in an attempt to make Carnivore more palatable for the public, renames the system DSC1000.
- **October 2001.** About six weeks after terror attacks against the United States, Congress passes the Patriot Act, giving the FBI more leeway in conducting online surveillance of terror suspects.

including the Internet or an ISP's network, individual computers check each incoming packet of data. If the packet is addressed to the individual computer, it captures and stores the data. If the packet isn't addressed to the individual computer, the computer passes the data along the network.

When a computer is using packet sniffer technology, though, it will capture and copy packets containing IP addresses under surveillance, as specified by the packet sniffer. The computer then passes the original packet along the network as it normally would, while keeping the copy. ISPs sometimes use packet sniffers to create backup copies of data that moves through their systems.

No data unturned. In some instances, a packet sniffer will be unfiltered, meaning it will capture all packets that pass through the network, such as email messages, Web page downloads, and streaming video files. If you host a Web site on a home PC, an unfiltered packet sniffer could monitor exactly who is visiting your site and any data users request. In other instances, a packet sniffer will be filtered, meaning it only captures packets containing a particular IP address or data string. Carnivore almost always is filtered.

Once a packet sniffer copies a packet, it stores the copy on a hard drive or another storage medium. The stored data often goes through additional data searches, even when using a filtered packet sniffer originally.

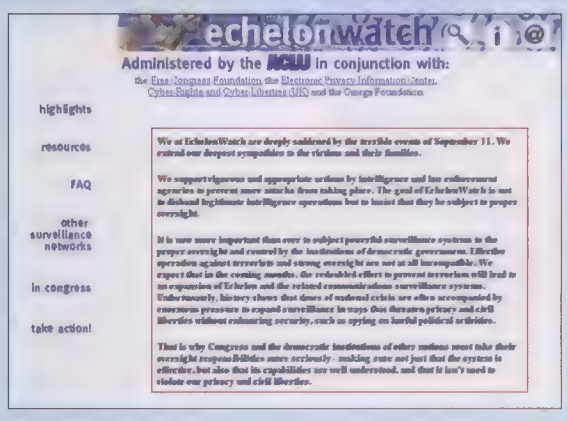
Echelon & The NSA

If rumors, movies, and certain Web sites are to be believed, Carnivore is only the tip of the iceberg when it comes to Internet surveillance. Rumor has it that the secretive NSA (National Security Administration) operates a monitoring system called Echelon that can globally search every email message and piece of Internet data for a few keywords, such as "bomb." Echelon, which reportedly is a joint surveillance network operated by the United States, Great Britain, Canada, Australia, and New Zealand, reportedly also monitors data from satellite communications, cellular calls, and fiber-optic cable.

Although the idea of Echelon monitoring every piece of global communications makes for good science-fiction fodder, U.S. governmental agencies have refused comment on whether Echelon exists. In 2000, the NSA blocked a congressional inquiry seeking details about Echelon.

A few organizations and Web sites believe the evidence of Echelon is strong enough that American citizens need to be wary of potential right-to-privacy and civil liberty violations. The Echelon Watch Web site, for example, calls for government acknowledgment of the existence of Echelon and other powerful surveillance systems and for democratic and public oversight of such systems. Several other Web sites, such as Cipherwar.com and EPIC.org contain stories about the existence of Echelon.

Rumors point to the existence of another NSA surveillance project, reportedly code-named Tempest, that could capture a computer's keystrokes or a computer monitor's images, even if the capturing computer isn't in the same room as or isn't connected in any way to the suspect's computer.



The Echelon Watch site (www.echelonwatch.com) keeps an eye on the NSA and its rumored surveillance system, Echelon.

Using Carnivore

With the packet-sniffer technology that's available, the debate over who should use it and how continues to grow. Here's a common question: Should the FBI be allowed to use a tool such as Carnivore to monitor any and all data that travels across the Internet? This question is a moot point because of wiretapping laws currently in place.

Legally, the FBI must obtain a court order before it can begin monitoring the Internet activity of a particular individual. The FBI would need to show a judge just cause for monitoring the individual's activities. With the court order in hand, the FBI installs a Carnivore computer on the network of the ISP that serves the suspect. (In some instances, the ISP might be able to perform the level of monitoring the FBI requires, negating the need for Carnivore.) The Carnivore computer will capture only the data that matches the IP address of the suspect. Depending on the scope of the court order, the FBI might need to further filter the captured data, leaving only email messages and removing all Web page downloads, for example.

After the surveillance ends, the FBI removes the Carnivore computer. The FBI can use any data obtained within the bounds of the court order against the suspect in a subsequent criminal case.

To Sniff Or Not To Sniff?

As the country's state of heightened security continues, federal officials would like to give law enforcement officials more leeway in monitoring the online activities of those suspected of terrorism. Those concerned with civil liberties remain wary of giving up too many freedoms to technologies such as Carnivore.

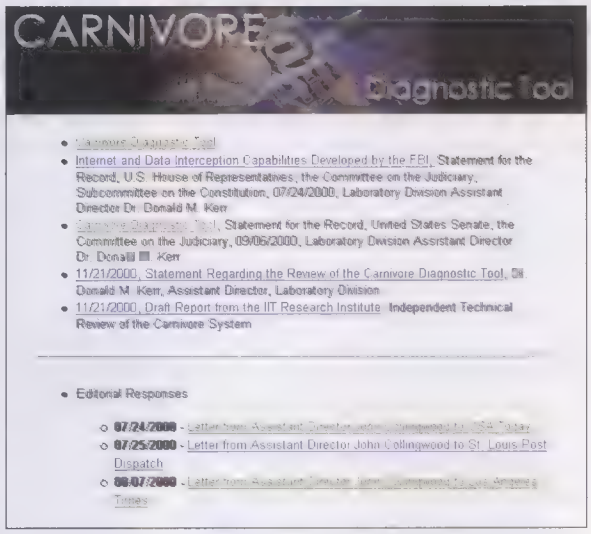
The Patriot Act, which Congress passed several weeks after the terror attacks, increased the ability of law enforcement officials to gather information on suspects. In the summer of 2002, the U.S. Justice Department was continuing to argue before the Senate Judiciary Committee for

additional rights for the FBI to conduct surveillance in publicly available areas of the Internet. Some in Congress want to go a step further, saying law enforcement officials should be less restricted by the need to obtain court orders when wanting to perform computer surveillance.

The hope among law enforcement officials is to gain even a few concessions to help them with surveillance, which will let them improve on some of the past successes they've enjoyed in using monitoring technology to capture criminals. The FBI has had success in using technology tools to re-create the recent computer activity of criminals, leading to key evidence in various cases.

However, no law enforcement agency, including the FBI, has been able to rely completely on technology to solve a case or gather key information. In some cases, limitations in the monitoring and surveillance technologies may have severely harmed the investigations. For example, some experts say they have developed technology that will thwart any email monitoring systems, including Carnivore. Others say Carnivore simply doesn't work as intended.

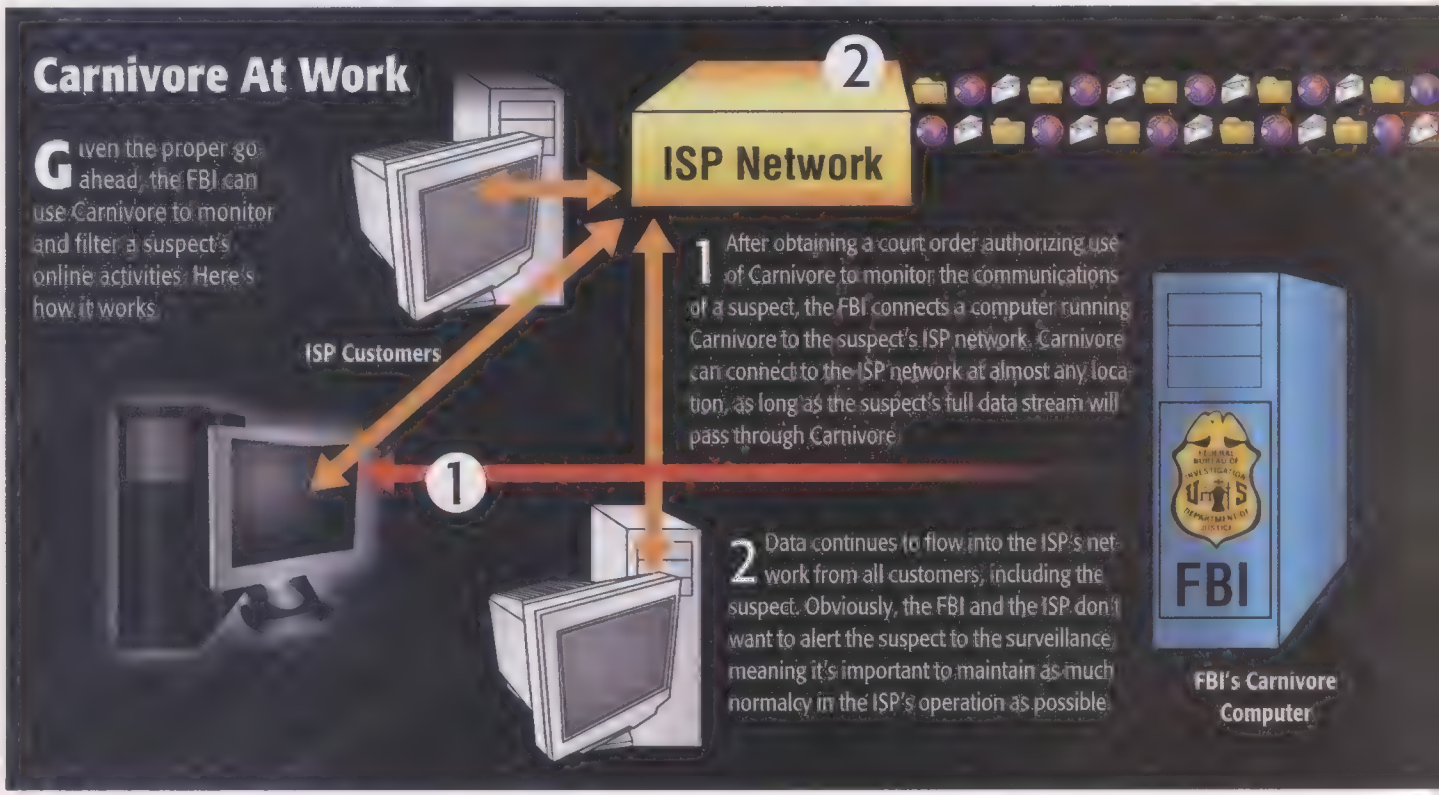
One well-publicized technology failure involved the FBI and Carnivore occurred before the 9/11 terror attacks. Early in 2000, an FBI agent had been using Carnivore to conduct some surveillance on an associate of terrorist Osama bin Laden. However, the Carnivore system failed to properly filter the gathered data, returning all email traffic from the suspect's ISP. Because of the glitch—which would be a violation of federal surveillance laws—the frustrated agent reportedly destroyed all of the gathered data, perhaps missing some information that could've prevented the attacks.



The FBI maintains publicly available data about Carnivore on its site at www.fbi.gov/hq/lab/carnivore/carnivore.htm.

Hello, Big Brother

Because of the relative ease with which the FBI can use Carnivore, some people are concerned the bureau could make mistakes, misinterpreting some of the data Carnivore obtains. Some fear tools such as Carnivore could intimidate honest citizens from fully exercising their rights of free speech, fearing the potential repercussions of an FBI investigation. Still others think law enforcement officials could abuse the power of Carnivore and use it before obtaining a court order or use it beyond the scope of the court order. The FBI, of



course, says such fears are unfounded because of the intense oversight of the FBI's use of Carnivore by the judicial system, the U.S. Department of Justice, and an internal FBI group.

Other fears are a little more far-fetched. Some think Carnivore could monitor all data on the Internet, giving the FBI the ability to begin investigating anyone and everyone. However, barring introduction of an amazing new surveillance technology, no organization, including the FBI, probably has the infrastructure or manpower necessary to conduct such widespread monitoring.

Although some people consider Carnivore eerily similar to the idea of Big Brother from George Orwell's book "1984," others think such monitoring tools represent basic necessities for law enforcement officials trying to battle terrorism. The FBI says Carnivore is simply a natural extension of its telephone-tapping capabilities. Criminals and terrorists now often use the Internet to communicate with each other, just as they have communicated by phone for decades.

Regardless of your personal feelings about the FBI or Carnivore, it's hard to argue against the fact that law enforcement officials could use some help in tracking dangerous criminals and terrorists, especially those with access to the latest high-tech communications tools. And, with the country on edge, many American citizens probably are more open to accepting the FBI's use of Carnivore.

In this case, results will be the ultimate key in shaping public opinion regarding Carnivore. If the software unfairly spotlights innocent citizens, comparisons to Big Brother will intensify. If, however, Carnivore lives up to its name, chewing up and spitting out potential terrorists, the American public probably will be willing to let the FBI increase Carnivore's bite. CPU

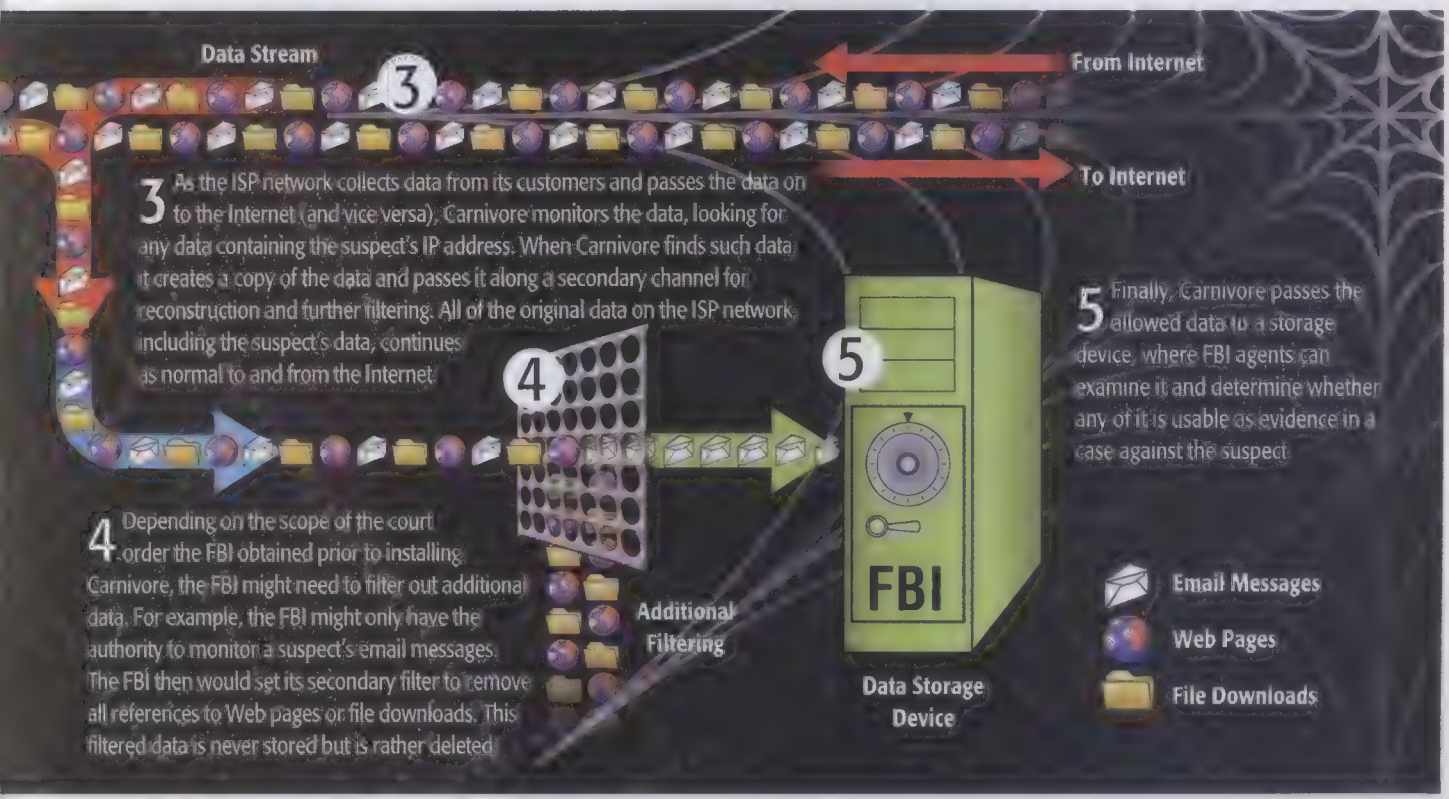
by Kyle Schurman

A Little Good News

Even with the continuing debate over Carnivore, the high-tech news coming out of the FBI isn't all controversial. Earlier this year, the FBI announced a renewed commitment to improving its ability to battle hackers, cybercrime, and cyberterrorists.

During a 2002 reorganization of the bureau, FBI director Robert Mueller announced formation of the Cyber Division. In a June speech to Congress, Mueller announced cybercrime now is the third-highest focus of the FBI, ranking only behind protecting the United States from terrorist attacks and espionage.

The Cyber Division gives the FBI a consolidated arena for conducting investigations into areas of cybercrime, including hacking, DOS attacks, theft of identity, and others. The FBI will investigate some types of cybercrimes at the local level, and the Cyber Division will provide guidance. Software piracy, software counterfeiting, and violation of copyrights will be key areas of focus for the Cyber Division. The Cyber Division also will work toward battling terror attacks against U.S. computer networks.



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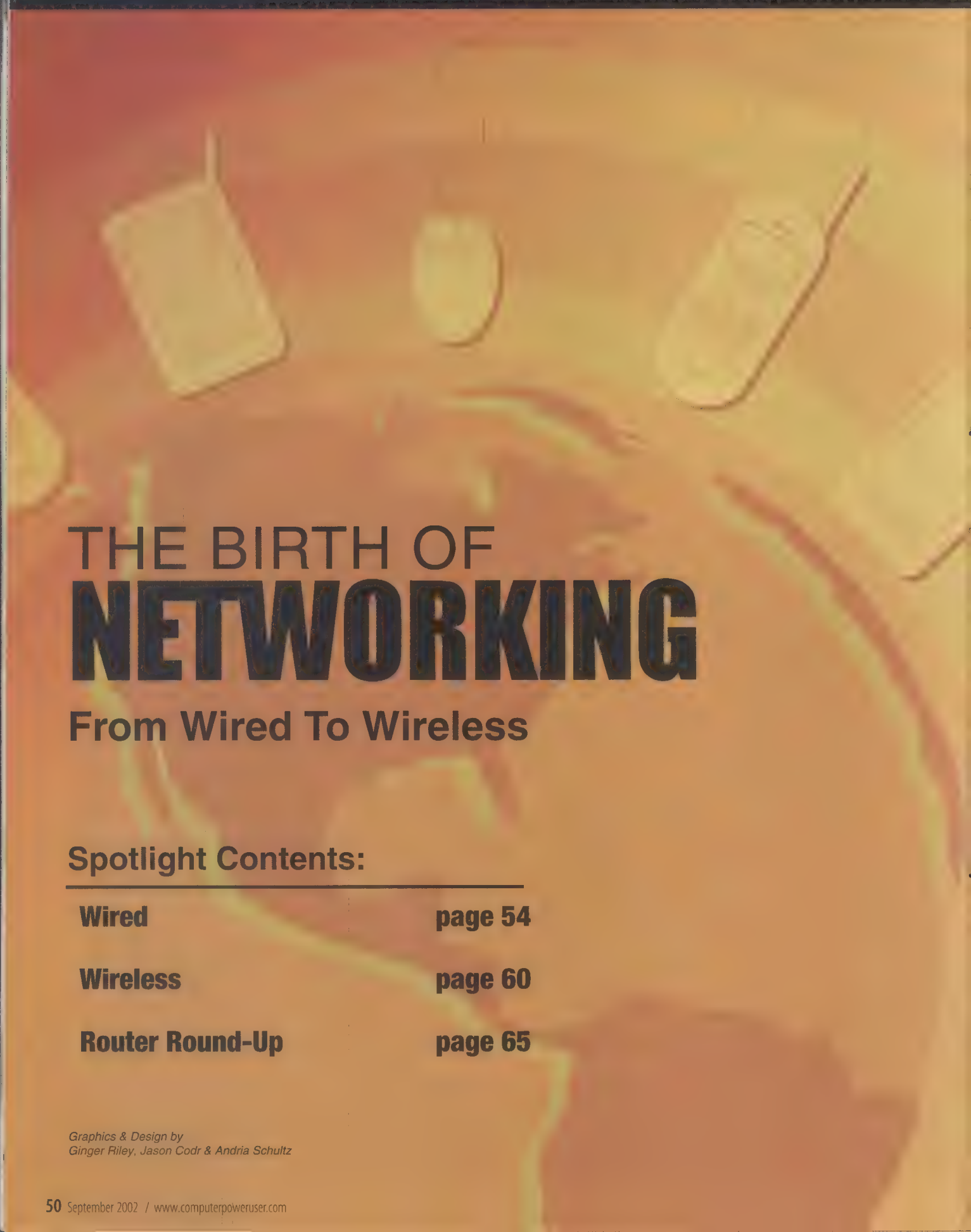


THE BIRTH OF NETWORKING

From Wired To Wireless

Spotlight Contents:

Wired	**page 54**
Wireless	**page 60**
Router Round-Up	**page 65**

Graphics & Design by
Ginger Riley, Jason Codr & Andria Schultz

Amazon.com. Short wave. XM Radio. Intranets. Instant messaging. Digital cable. Ultima Online. GPS. Telephone calls. Broadcast television. Banking. Email.

When Samuel Morse sent the words "What hath God wrought" from Washington, D.C., to Baltimore in 1844, the age of electronic networking was born. Ever since, we've been on an all-out quest to send more data to more places via any and all methods. The rise of LANs and the Internet in the last 40 years have transformed life in virtually all aspects of the corporate, entertainment, educational, and military spheres, not to mention international and interpersonal relations.

If you work in an office, you're probably on a network. At home, however, you may still be holding out. Wired? Wireless? Tough call. Stringing CAT 5 cable down the hall or through walls is a drag, but wireless is more expensive, harder to configure, and not even industry experts know which format will prevail in the near future.

One thing is for sure, houses with multiple PCs are becoming the norm, and if you're reading this article, you probably have old equipment that's begging for a new lease on life. So let's talk networks, shall we?

Networking In Half A Glance

Perhaps the key concept behind today's digital networks is the sending of packets, a process TCP/IP governs. Sending large chunks of data is fraught with problems, owing to factors such as bandwidth and line noise. Instead, files are broken up into data packets, with each packet saddled with information about its target destination and how it's to be reintegrated at the far end into the original file. Networks are designed such that servers, like post offices, keep passing on packets until they reach their destinations. If a packet is lost, the sending machine is instructed to resend it.

Sometimes, how a packet reaches its destination has an inherent amount of flexibility built into the process. Back when the Department of Defense was designing the embryo of today's Internet, the idea was to create a data network capable of withstanding a nuclear catastrophe. Packets traveling from Seattle to Los Angeles might dynamically reroute through Salt Lake City if San Francisco were to suddenly be blown off the map.

Today, these same principles help manage Internet congestion and large corporate WANs. If one network link is stuffed with traffic, alternate paths can handle packets to help balance the total network load.

At a slightly higher level, a network has five basic components: device, adapter, operating system, connection, and hub.

- A device can be a computer, modem, printer, NAS (network attached storage; essentially a hard drive that you snap onto an Ethernet network), or similar hardware.
- Inside each device is an adapter (we would say this a NIC, however NICs are now giving way to integrated motherboard circuitry) that facilitates between the device and the connection.
- Devices need an OS to help communicate with other network nodes. The list to choose from includes WinXP, NetWare, Unix, Mac OS X Server, and others.
- The connection links nodes, be it by RJ-45 cable in an Ethernet or 2.4GHz radio waves in an 802.11b wireless network.
- To help control and distribute network traffic, most networks require a central device, such as hubs, routers, switches, and other product types, depending on their specific functions. On a small, four-system Ethernet, a hub would provide the physical junction between all four systems. (For a look at router reviews, see "Get Ethereal" on page 65.)

The traditional goal of a LAN is for servers to share files and resources (hard drives, printers, modem connectivity) with clients. Sizable companies and home-based performance freaks often have dedicated servers that exist solely to handle certain network tasks. More recently, homes and small offices are adopting peer-to-peer networks where systems function as servers and clients, with each network member sharing its resources as part of the collective whole. Because the various 802.11 wireless standards are rooted in 802.3 Ethernet, one network can seamlessly use wired and wireless nodes with the proper hardware. (For more on wired networks, see "Down To The Wire" on page 54. For more on wireless networks, see "PCs Unplugged" on page 60.)

Networking Before

Back when mainframes roamed the earth and minicomputers from Digital Equipment flourished in labs, researchers needed a way for these systems to "talk."

A Networking Timeline

1837–American Samuel Morse and British physicist Sir Charles Wheatstone independently devise telegraph systems. Morse's device sent the first public telegraph communication in 1844.

1888–Heinrich Hertz generates and detects the first known radio waves.

1895–Guglielmo Marconi broadcasts a radio signal and receives it 1.5 miles away. In 1901, he broadcasts radio waves across the Atlantic Ocean.

1961–MIT's Leonard Kleinrock publishes the first paper on packet switching theory.

1962–MIT's J.C.R. Licklider discusses his Galactic Network concept in which the world is full of networked computers everyone can use to access data and programs.

1965–American Ted Nelson coins the term "hypertext" to embody the concept of accessing textual data in a nonlinear fashion.

1966–Charles Kao and George Hockham prove that data transmits as light beams over glass fibers, paving the way for high-speed fiber-optic communications.

The LXT16706/7 is Intel's multiplexor/demultiplexor chipset for use in 10Gbps telecommunications gear, such as OC-192 systems. Although it seems improbable that 10Gb equipment will ever be used in homes and small offices, the same was said of 100Mbps Ethernet years ago.

Slowly, the bits and pieces coalesced, thanks mostly to funding from the DoD. By the 1980s, we had Ethernet for LANs and WANs and the Internet for letting the thousands of burgeoning networks converse.

Closely tied to the development of networking standards and protocols is bandwidth. If the backbone, or major connecting link, running through a network can't cope with the traffic generated in the nodes, network performance suffers and users are left twiddling their thumbs. Many offices are now upgrading their LAN and WAN backbones from 100Mbps to 1Gbps Ethernet. In 1986, NASA and the Department of Energy created NSFNet (National Science Foundation Network) for a faster backbone (a fiery 56Kbps) than ARPANet (Advanced Research Project Agency Network). Three years later, NSFNet upgraded to a T1 (1.544Mbps) backbone. In contrast, most of today's Internet backbone links are either OC-48 (2.488Gbps) or OC-192 (9.952Gbps) fiber optic connections.

Wireless networking also owes a heavy debt to the U.S. government. Spread spectrum entails sending pieces of a data stream across multiple frequencies in a sequence known to only the sender and receiver. This foils eavesdroppers—as the Allies did during World War II—and guards against prolonged interference on any given frequency. This is also why you can use a 2.4GHz cordless telephone and Wi-Fi network adapter in the same room and both devices will continue to work.

Luckily, the 900MHz and 1.6Mbps wireless standards that confused the wireless networking market in the late '90s have vanished. The contenders left standing are the three flavors of 802.11 and HomeRF (www.homerf.org). However, despite recent spec improvements, Intel's defection from HomeRF to 802.11b in 2001 has likely sealed that would-be consumer standard's fate.

Connecting Today Into Tomorrow

Going with a wired or wireless connection depends on your needs. Usually, wired connections are faster and more stable, but wireless enables mobility without losing the network connection.

There are alternatives to 802.3 and 802.11, particularly in the home. Networking technologies using power lines (HomePlug; www.homeplug.org) and phone lines (HomePNA; www.homepna.org) already built into homes offer greater convenience than stringing RJ-45. But as Anthony Ambrose, director of marketing for Intel Communications Group, says, "Don't ever bet against Ethernet. Gigabit Ethernet will be the standard for commercial desktops starting now. It'll take a little longer to get into the home, but power users can now do gigabit pretty inexpensively. And just expect wireless to be everywhere."

Ambrose predicts that like today's cell phones, wireless adapters will soon include dual-mode and tri-mode functionality covering 802.11b, 802.11a, and the soon-to-be-finished 802.11g. One wireless adapter should work in any environment—a necessity to handle the expected wave of "wireless hot spot"

1969—DARPA networks four computers in California and Utah, creating the first links in the ARPANet, from which grew the Internet.

1971—Ray Tomlinson puts the @ in email, sending the first electronic mail message across a network.

1971—The University of Hawaii's ALOHANet becomes the first wireless data network.

1973—Xerox PARC's Robert Metcalfe invents Ethernet.

1973—Robert Kahn and Vinton Cerf develop TCP/IP.

1980—Tim Berners-Lee writes the Enquire program, which facilitates links between arbitrary nodes.

1980—The IEEE adopts the 802.3 Ethernet spec.

1983—Novell releases NetWare, the first file-sharing LAN OS.

1984/5—ARPANet starts to become available to higher education institutions regardless of whether they participate in computer research.

1990—ARPANet is decommissioned because government-backed networks such as NSFNet and the fledgling Internet are well under way.

1990—Berners-Lee develops a graphical hypertext browser and editor he dubs "WorldWideWeb." The project becomes known as World Wide Web.

terminals that will soon blanket airports and coffee shops everywhere.

The wild card in today's wireless scene is Bluetooth. Now three years into Bluetooth's life, this short-range radio technology is really just at last gaining traction in notebooks, cell phones, and PDAs. Whether Bluetooth will expand PANs (personal area networks) into automotive and home electronics remains to be seen.

Kurt Scherf is vice president of research at industry analysis firm Parks Associates. He predicts that "20% of all U.S. households will have a data network by the end of 2006. In that same time period, there will be 125 million connected end products in place in U.S. households for entertainment-related applications." Already, Ethernet-based MP3 components are being added to home theater systems, and broadband providers are aching to find methods of delivering on-demand audio and video content that they can distribute over home networks.

According to Intel's Ambrose, the inability to run high-quality multimedia over the network still remains one of the chief impediments to consumers looking to adopt home networks. "Not having to worry about where you are and being able to access your information, your entertainment content, and each other at any time, anywhere, over any device—isn't that the holy grail of networking?" CPU

by William Van Winkle

David Boggs, Co-Developer Of Ethernet

Bob Metcalfe was the principle inventor of Ethernet at Xerox's Palo Alto Research Center in 1973, but David Boggs was a key player. One could argue he was Metcalfe's right-hand man during Ethernet's critical gestation stage, which explains why Metcalfe listed Boggs second on the Ethernet patent. Boggs has remained active in networking since, contributing to the leap from 10Mbps to 100Mbps Ethernet and delving deeply into digital telephony. Boggs' recollections of Ethernet's origins three decades ago (see www.smartcomputing.com/cpumag/sep02/boggs) are encyclopedic, but his thoughts on Ethernet's subsequent development and today's networking industry are equally intriguing.

CPU: Why is Ethernet still the standard today?

Boggs: *Ethernet is standard because it's simpler than any of the other network designs around. Compare the complexity of Ethernet and the complexity of ATM or Token Ring. Plus, by now there are guys who have known Ethernet all their lives. They grew up with it, got taught about it in college. We've also been able to extend Ethernet several times now, from 10Mb to 100Mb. The first Ethernet was actually a 3Mb, so the 10Mb is actually the second version. Originally, we tried to scale it to 20 and then back off to 10, but we did finally scale it up to 100. I wasn't involved in the scale from 100 to 1,000, and now it's been scaled from 1,000 to 10,000Mb.*

CPU: Is today's Ethernet more or less the same technology it was when you helped Bob Metcalfe invent it?

Boggs: *At this point, the only thing left of the original Ethernet idea is the packet format. The [CSMA/CD] Carrier Sense Multiple Access with Collision Detection barely made sense at 100Mbps. It makes no sense at all at a gigabit per second and negative sense at 10Gbps. The only thing left is destination source type and 1,500 bytes of data with a CRC [cyclic redundancy checking] at the end. And the concept that when you launch a packet on an Ethernet, every system will give its best effort in forwarding the packet to its destination, but there's no guarantee that it will arrive, and if you really care about the data, you have to keep a copy and be prepared to retransmit it. That's really all that has survived. The so-called media access control, MAC, is long gone.*

CPU: What's your take on today's wireless networking scene?

Boggs: *I was always rather skeptical of 802.11, but I must admit this was mostly ego. I looked down upon them as sort of ripping off Ethernet, trying to ride on its success—and it ran at 2Mb, anyway, but that's unjust criticism. It turns out wireless is an extremely hard problem, and given the technology that was available at the time, the 2Mb design was a pretty darn good effort. The current stuff, 802.11b, which runs at 11Mbps, is probably about the only hot area in networking around right now. The newer 802.11a is 54Mbps. 802.11 is essentially about my two chief interests: digital phone network and packet radio. In fact, I'm thinking to myself: Gee, maybe I should find something to do in packet radio next. I've sort of ridden this digital telephone thing into the ground, and all the telephone companies are collapsing, anyway.*

1993—Marc Andreessen's Mosaic for X (the forerunner of Netscape) goes to alpha.

1994—The IEEE's 802.3u spec enables extension of Ethernet to 100Mbps.

1996—AT&T, Fujitsu, and Nippon Telegraph and Telephone demonstrate a fiber-optic transmission rate of 1 trillion bits per second.

1997—The IEEE adopts 802.11 as a wireless networking standard. 802.11b (at 11Mbps) follows in 1999.

1998—Gigabit Ethernet (IEEE 802.3ab and 802.3z) becomes a standard.

1999—Bluetooth v1.0 final spec is released.

2001—Lucent and Sprint PCS demonstrate 2.4Mbps cellular phone communication.

2002—The FCC approves UWB use in the 3.1GHz to 10.6GHz radio spectrum, paving the way for future PANs running at several hundreds of megabits per second.

2002—The final spec for 10 Gigabit Ethernet (IEEE 802.3ae) becomes a standard.

DOWN TO THE WIRE

Wired Networks Still Make The Connection

The wired network isn't going anywhere, at least not in the near future. Wireless networks are making great strides in performance and scalability, but they still don't come close to hard-wired networks in terms of overall reliability, price, and performance.

From Many To One

Depending on the technology your network supports and the type of cable you use, the wired network comes in different topologies and speeds. Even though your choice of networking technology has diminished to really just one, you still have a few viable choices when it comes to picking the physical cable plant (another name for physical cable installation) to install or upgrade to. As you'll see, some are better choices than others, but depending on your needs, all will work in many situations. See "The Cable Connection" on page 58 for more information.

In years past, choosing your network meant making some rather critical decisions based on the software you wanted to run. This narrowed your choices of what network speed, topology, and network operating system you could use. Because PC-based networks were still rather new and there wasn't much, if any, interoperability among network vendors, many software packages were written to only run on one or two network platforms. You had to tread lightly or not at all. Of the networking technologies out there, only three had enough industry support to be considered for a commercial installation.

ARCNET

One of the first networking technologies developed was ARCNET. First released by Datapoint on Dec. 1, 1977, it was developed specifically for Datapoint's customers because they needed to connect their computers. Like Ethernet and Token Ring, ARCNET has no predefined application layer; the application simply makes its request for data through the OS, and the underlying networking layer takes over. This means ARCNET doesn't care what application you run on top of it, and you don't have to write your application specifically for ARCNET.

Information flow. ARCNET has built-in flow control so that no two nodes on the network can communicate at the same time. Ethernet, in contrast, uses a method of allowing transmission that can often lead to two nodes "talking" at the same time, causing collisions and slowing down overall network performance. Also, ARCNET uses a token-passing scheme, which means access to the media (cable) is determined by the node with the token. This token is made up of header and trailer information that contains source and destination addressing, as well as the data payload. When a node receives a token, it has the right to transmit data or pass on the token if it has no data to pass on. The combination of flow control and token passing helps to prevent network data collisions.

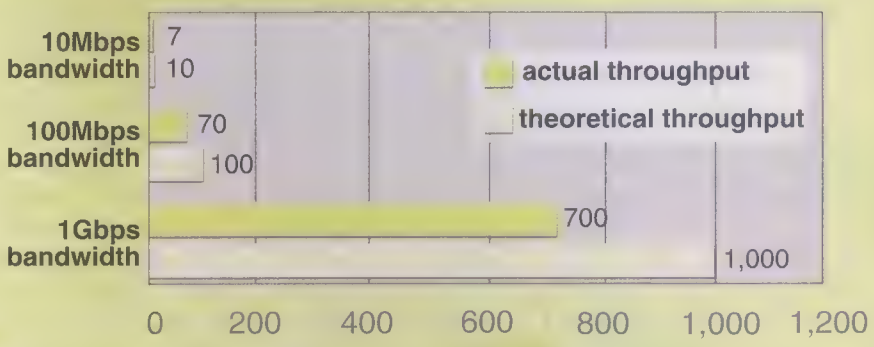
ARCNET was first released with a data speed of 2.5Mbps, which was the same throughput rate available on most disk controllers at that time. As chip technology evolved and faster chips made their way onto ARCNET controller boards, ARCNET's throughput increased to 10Mbps, the same as Ethernet's debut speed. It also originally used passive or active hubs with cabling laid out in a star topology.

ACRNET is no longer a viable option to consider when installing or upgrading your network for a number of reasons. For one, it is limited to a maximum of 255 nodes on one network. This limits its use on large corporate networks. Next, it still only operates at a maximum speed of 10Mbps, far too slow for today's bandwidth-hungry data centers and server farms. Lastly, although it is still in development and in use overseas, finding ARCNET hardware and support is becoming more and more difficult in the United States.

ARCNET has found its niche in embedded networking technology and is often found in building automation, robotics, transportation, and industrial control. Its token-passing scheme makes it an ideal choice for projects that require timely responses, such as robotics. ARCNET has also grown out of its star topology and into a bus topology. This too lends itself well to embedded network situations because the hub or switch, as Ethernet requires, has been eliminated, reducing cost and complexity.

Measurements: Theoretical vs. Actual

Now that you have gone out and bought the latest and greatest network hardware for your home power network, are you really going to see all of the bits you paid for? The answer is an unequivocal maybe. Other than the rated bandwidth of the wiring, there are other factors that determine the overall efficiency, and ultimately the overall throughput, of your network.



One of the biggest factors is latency. Network latency is the time it takes for a data packet to make it from its source to its destination and back again. This time is usually measured in milliseconds, with typical times ranging from 10 ms or less for local Fast Ethernet connections to more than 100 ms for Internet broadband connections. If your connection suffers from high latency, your overall throughput will suffer because you can never "fill the pipe." Typically, if you see 70% to 80% of the advertised throughput available on your network segment, you are pretty close to getting all you are going to get out of your network connection.

Speed things up. You cannot completely do away with latency on your network, but there are some things you can do to help minimize its impact on network performance. Congested network segments, slow or congested routers, proxy and caching servers, and busy servers or devices at the destination end of your request can cause network latency. Some of these causes are within your control to correct, but others are not.

To help clear up congested network segments, upgrade your hub to a quality switch, which will better segment traffic between network nodes. A network switch can improve network response by as much as 50% or more on busy network segments. Switches from Cisco (www.cisco.com), 3Com (www.3com.com) and D-Link (www.dlink.com) come in all shapes, sizes, speeds, and port counts.

If you suspect that your router, server, or other network device is part of your latency problem, check with the device's vendor about possible performance enhancements. It may simply take an installation of more RAM in a router or server to reduce latency and improve overall performance.

Token Ring

Developed and championed by IBM in the mid '80s, Token Ring became the de facto standard for corporate networking, especially those networks with IBM hardware. Just like ARCNET, Token Ring is a data-link technology that allows total application-level abstraction and independence. As its name implies, Token Ring is a token-passing protocol, much like ARCNET, that conforms to the IEEE 802.5 standard. Laid out in a star topology, Token Ring uses a 24-bit continuously circulating token to control access to the ring.

Vital stats. Token Ring runs at three speeds: 4Mbps, 16Mbps, and 100Mbps. Also, Token Ring can have a maximum frame (data packet) size of 17,800 bytes, significantly larger than ARCNET's 508-byte limit. This allows for more information to be sent in a single frame, reducing the number of tokens needed to complete a conversation. To be fair, the maximum frame size for Token Ring depends on timing considerations and the cable lengths that make up a single ring. The longer the cable lengths, the smaller the frame has to be so that nodes can pass tokens at the proper ring speed. Token Ring can run on 9-pin shielded twisted pair, CAT 5/5e, and also fiber.

Token Ring, like Ethernet, can assign priority bits to frames for special processing. Token Ring supports both 802.1p and 802.1q standards. 802.1p provides for queuing inside a LAN bridge that lets certain tokens be assigned a higher forwarding and transmission priority than other tokens. Being able to assign higher priority tokens becomes important when trying to handle time-delay sensitive information such as voice and video over the network.

802.1q lets the token accept user-defined priority information as part of the MAC (media access control) frame. This becomes important when working over translational bridges that take Token Ring frames and map them to Ethernet frames. 802.1q provides a method for setting the same priority on the Ethernet frame as was on the Token Ring frame.

Popularity constraints. Still widely popular in IBM-centric enterprises, Token Ring isn't necessarily the first choice anymore when it comes to new installations. The biggest reason is cost: The typical Token Ring adapter is five to 10 times more expensive than its Ethernet counterpart. For the newest 100Mbps Token Ring adapter, expect to pay around $200 for a single PCI adapter! The hubs, or MAUs (Multistation Access Units), are also way up there in price, with the typical cost of a 24-port MAU at almost $2,000.

Another reason for Token Ring's drop in popularity is that it isn't nearly as

compatible as Ethernet. Most computing devices, if they have wired networking built in, are wired for Ethernet compatibility, not Token Ring. The cost of components is a major contributing factor to this, but another factor is simply that Ethernet has taken over networking in much the same way that Windows claimed desktop PCs. So in order to be compatible right out of the box, vendors do not usually opt for Token Ring.

Ethernet

By far the most popular networking standard in use today is Ethernet. Developed in the early 1970s at the Xerox PARC (Palo Alto Research Center) and standardized in 1980 by the IEEE as 802.3, Ethernet provides a flexibility and throughput rate you won't find with Token Ring or ARCNET. Ethernet first arrived on the scene running at 10Mbps over what is often referred to as Thicknet, or 10Base5, using RG-8 or RG-11 coaxial cable. Thicknet was later replaced by a smaller, more flexible coaxial cable, referred to as Thinnet, or 10Base2. Thinnet ran on RG-58 coax cable, which is about half the size of 10Base5.

The most popular form of Ethernet now is 10BaseT using CAT 3 (or better) UTP (unshielded twisted pair) copper cable. UTP is smaller still than 10Base2 and provides better noise reduction than coax cable. Because of its small size, UTP is easier to install in walls and ceilings. Also, UTP costs less per foot than coax, making it more cost-effective. 10Mbps Ethernet also runs over fiber for long-distance installations.

Ethernet development continued, and we now have 100Mbps Fast Ethernet and 1,000Mbps (1Gbps) Ethernet. Both of these technologies require CAT 5/5e UTP or fiber-optic cabling. Ethernet is a layer 1 and 2 technology, which means that higher-level protocols can run over it without modification. Some of these protocols are TCP/IP, NetBEUI, IPX/SPX, DECNet, and AppleTalk. All popular PC OSes come with support for Ethernet and its associated protocols, and all network hardware vendors have a line of Ethernet-compatible products.

A few faults. Although it is the most popular networking technology, Ethernet is far from perfect. An Ethernet frame has a maximum size of 1,518

Secure Your Wires

You've got the hottest home network on the block. Now you'll want the best way to keep nosy "script kiddies" out. Script kiddies are not hackers in the real sense, but they can still stir up a mess of trouble if left unchecked. Scores of scripts automatically check for weaknesses in security features without requiring any real technical knowledge on the user's part. Some weaknesses these scripts look for are blank or missing passwords, known DNS or SendMail exploits, and unsecured services running on open TCP ports. The scripts report back what they have discovered, and the user goes on to the next step, just like instructions in a recipe.

You can do a number of things to reduce the chances of being "hacked," and most of them are cheap and easy to implement.

Firewall. Keeping track of "good" and "bad" network traffic is the job of a firewall. Firewalls come in various shapes and sizes, as well as implementations. Client firewalls are programs that monitor network traffic, specifically TCP/IP packets as they come and go to your local computer. Programs such as BlackICE PC Protection (www.iss.net) and ZoneAlarm Pro (www.zonelabs.com) run on your PC and alert you to possible harmful network traffic. Based on specific rules, these programs check all incoming and outgoing TCP/IP packets to see first if the traffic is allowed. If it isn't, the programs throw up an alarm, letting you know of the potential threat.

Another way to protect your home network at the "front door" is to use a combination router and firewall between your network and your broadband connection. Linksys (www.linksys.com) and SMC Networks (www.smc.com) each have router/firewall combinations to meet your needs and budget. The biggest thing this type of firewall provides you with is NAT (Network Address Translation). This is the process of taking a single public (real) IP address on the Internet and using it to masquerade your entire network. For example, you would set up your computers with a nonroutable address range such as 192.168.0.XXX. NAT takes this private range and funnels it all out to the Internet using the single public address. This makes hacking or exploiting your network nearly impossible from the outside.

Antivirus. Don't neglect your antivirus software when thinking about securing your network. Email-borne viruses could cause more harm than any would-be hacker. Antivirus software such as Norton AntiVirus (www.symantec.com) and McAfee VirusScan (www.mcafee.com) are good first-line defenses against Trojan horses and macro viruses. Keep your virus signatures up to date or periodically scan your PC over the Internet from Trend Micro's Web site (www.antivirus.com). Click Free Tools for a free scan.

Another potential security violation in the making is malware/spyware. Popular peer-to-peer file-sharing programs have been known to contain hidden "features" and back doors. Be careful when using programs such as ICQ, Morpheus, and KaZaA.

The Power User Home Network

You have your new P4. You have broadband. You have three other computers. You have an Xbox. You want to hook them all together and play games over the Internet. You need a home network.

Home networking has come a long way in the past five or so years. No longer thought of as "strange" or "off the wall," home networking is growing at a rapid rate. You have choices: wireless networking, Home PNA (a standard for data transfers as large as 1Mbps over telephone wire), PowerNet (a standard for networking as much as 14Mbps over your existing AC power wiring), and good old Ethernet. Which one is right for a power user?

All things being equal, we have to say that Ethernet is the only way to go for a full-scale, high-performance home network. 100Mbps Ethernet is cheap and easy to install and is a proven technology. But is 100Mbps enough, or should you go for more? The next step up is to today's current cutting edge: 1 Gigabit Ethernet. Does a home network really need–or can it even use–all this bandwidth? The answer is no. Even with the latest PC hardware, a small handful of PCs cannot even come close to taking up all of the bandwidth available in a 1Gb link. Also, with prices for Gigabit Ethernet still rather high, when compared to Fast Ethernet, it is hard to justify installing Gigabit Ethernet.

Companies such as D-Link (www.dlink.com) and 3Com (www.3com.com) each have small- to medium-port-count 10/100/1,000Mbps Ethernet switches suitable for home networking, but expect to pay $800 or more just for a single 8-port switch.

If you do decide to go with the 1 Gigabit Ethernet backbone, keep in mind that you still may not be able to surf the Internet any faster or play Counter Strike with your little brother any quicker. Essentially, all this will do is move the speed bottleneck to a different part of the system. If it's not the network, it will be the PC. If it isn't the PC, it will be the broadband connection. With 1 Gigabit Ethernet prices still way up there when compared to Fast Ethernet, the cost vs. performance ratio just doesn't justify the expense, and it probably won't for at least a couple of years.

bytes. This is still a little more than three times ARCNET's frame size, but much, much less than Token Ring's potential maximum frame size. This means that large chunks of data must be broken up into several frames before they can be transmitted, potentially causing excessive traffic and collisions.

Also, unlike with the anticollision token-passing technologies of ARCNET and Token Ring, it is possible for two (or more) devices on an Ethernet network to try to transmit at the same time. Ethernet uses CSMA/CD (carrier sense media access/carrier detection) to determine if a node can transmit a frame onto the network. If two nodes do step on each other and frame corruption occurs, the bad frame is discarded, and the sending node is alerted that it needs to retransmit the frame. This is allowed for and handled by special algorithms built into the network adapters. Multiple collisions on a network segment can greatly reduce the overall efficiency of the network and degrade performance. Ethernet switches help reduce the chance for collisions and improve network performance on busy networks.

You can buy Ethernet starter kits at your favorite computer boutique (try to find an ARCNET or Token Ring kit!), and home networking has flourished because of Ethernet's ease of use and installation. With its popularity came more and more sources for hardware, which helped drive down prices. It is common to find Ethernet network adapters for less than $20 and switches for less than $50.

10 Gigabit Ethernet & Beyond

Gigabit Ethernet has hardly had a chance to become established in the marketplace, and networking vendors are already working on stepping up the speed quotient again. Although nowhere near ready for prime time, 10 Gigabit Ethernet is already on the drawing boards and headed for future development. Expect to see 10 Gigabit Ethernet first developed for fiber, if at all for copper, in some future form.

One problem with speeding up our network connections is that unless some major advances in server/desktop operating software and internal PC components take place, none of us will truly be able to take advantage of all that bandwidth. Most multiprocessor Windows 2000 servers can barely fill a 1Gb pipe, and we are already talking about 10 times more bandwidth. We'll have to deal with latency and other performance-robbing network gremlins in order to help keep things cruising at top speed, or else, why bother? CPU

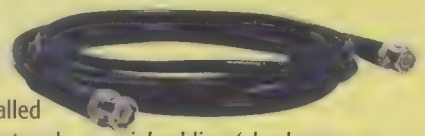
by Keith Schultz

To see a graphic explaining the different wired network topologies, go to www.smartcomputing.com/cpumag/sep02/wired.

The Cable Connection

Your wired network decisions boil down to making a choice based on performance, distance of the physical cable installation, and cost to install. Coaxial and CAT 3 UTP (Category 3 Unshielded Twisted Pair) are good for low-end networks that do not require performance over 10Mbps. CAT 5/5e UTP, single-mode fiber, and multi-mode fiber offer the most flexibility when it comes to network topology and speed. CAT 5/5e and fiber support a range of network speeds from 10Mbps on up to Gigabit Ethernet.

Coaxial



Popular once but rarely installed now for new networks, coaxial cabling (also known as 10Base2 or coax) is a linear bus topology that has two distinct ends terminated by 50 ohm resisters. The physical structure of the cable is a braided shielding surrounding a single core wire.

Pros:

- Long cable lengths

Speed:

- 10Mbps

Cons:

- Linear bus topology: one break and the entire network fails
- If the cable fails, the whole network fails
- Physical structure limits the throughput rate

Distance:

- 660 feet

CAT 5/5e

There are a number of reasons why CAT 5/5e is the de facto standard for any new inside cable plant, not the least of which is that it supports all current Ethernet technologies and speeds. (CAT 5e is the result of an enhancement to the CAT 5 spec. Except for very cheap, low-end cables, all CAT 5 cables are CAT 5e.) CAT 5/5e UTP is laid out in a star topology, unlike coax's linear bus. A CAT 5/5e cable is composed of four pairs of wire, for a total of eight wires, with each pair twisted together for the length of the cable. These twists provide some insulation from outside interference.

Pros:

- Supports throughput rates that are faster than coaxial
- Small cable, easy to install
- Wide range of hardware support
- Star topology

Speed:

- 10, 100, 1,000Mbps

Distance:

- 330 feet

Cons:

- Limited cable length
- Requires centralized hub or switch

Fiber Optic

We have seen the future of network cabling, and it is made of glass. Because of its immunity to outside noise and interference and its nearly limitless capacity to carry data, some form of fiber-optic cable will be the physical networking plant for years to come. Currently, all speeds and flavors of Ethernet run on fiber, and all planned speed enhancements will also come out first on fiber. The difference between multi-mode and single-mode fiber-optic cable is that multi-mode fiber is distance-challenged. You can only run multi-mode fiber in runs up to 1.2 miles without installing and using a repeater. Single-mode fiber can run 30 miles or more.

Pros:

- Nearly limitless capacity to carry data
- Long cable length
- Small cable footprint
- Wide range of hardware support

Speed:

- 10, 100, 1,000Mbps

Distance:

- Multi-mode: 1.2 miles
- Single-mode: 31 miles

Cons:

- Physical cabling costs more than CAT 5/5e or coax
- Fiber-ready network hardware (hubs, switches, etc.) is more expensive than comparable CAT 5/5e
- Harder to repair broken fiber cables
- Susceptible to physical damage

Copper's Possible Future: CAT 6 & CAT 7

Technically, CAT 6 and CAT 7 don't yet exist. Both specifications are still in the "working draft" mode with all of the standards bodies, such as the TIA (Telecommunications Industry Association) and the ISO (International Standards Organization). When ratified, CAT 6 will likely support 350MHz signaling. CAT 5 supports 100MHz signaling; the higher the signal rate, the faster the cable can run.

The ISO has specified a 600MHz signaling standard that is generally thought to be what CAT 7 will become, but it is unlikely to gain a foothold in North America. The ISO specification requires shielded twisted pair (CAT 5/5e is unshielded twisted pair), which is not commonly installed in North America. More than likely, the decision would be between CAT 6 and fiber-optic cabling instead of CAT 7.

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PCs UNPLUGGED

Wireless Puts The Cool Back Into Computing

Just when you thought computing had lost its luster, that PCs have become commonplace commodities now in every American den, that the hip ethos had dripped off Web surfing pretty much on the same day your grandma learned how to use email, wireless networking comes along to re-establish the PC's patina of cool. Want to see your neighbor's jaw drop? Take your Wi-Fi-connected notebook out on the back deck, crack it open, and surf on over to your favorite real-time sports page. Then start calling out the current scores across the NFL as he rakes his backyard. You might even want to walk the notebook over to him and show off a streaming video clip. Yeah, this stuff is still cool.

Within just a couple of years of wide availability for homes and small offices, WLAN has reinvigorated personal computing and given geeks like us a new reason to live. The prospect of having wire-free access to your own computer files, email, or the Web from anywhere in your home (or the neighbor's backyard) or even city parks, airport lounges, and coffee shops is the new dream of unleashed computing.

While PC sales stagnate and the Web itself goes through an economic depression, wireless is one high-tech area that is enjoying boom times. According to Cahners InStat Group, wireless equipment sales will have grown from $1.9 billion in 2001 to $5.2 billion in 2005. A recent Microsoft-sponsored survey found that WLANs are already in place among 40% of businesses of all sizes, with 31% planning to deploy them in the next 18 months. Whatever happened to the PC revolution? Apparently, it took to the airwaves. And we have one protocol to thank for this: 802.11.

It's Good To "B" King

In an effort to standardize what could have been a morass of conflicting wireless protocols, IEEE laid down the 802.11 standard in 1997. The appeal of the 802.11 protocols was that they tend to use pieces of the radio spectrum that were not highly regulated by the Federal Communications Commission and did not require any special licensing to use. The initial 802.11 standard used the 2.4GHz band, the same remote phones, microwaves, and remote controls use, to deliver a theoretical speed of 11Mbps. Wireless networking started as an exotic technology in the late 1990s that appealed only to certain vertical industries, such as retailing and health care, where accessing shared information anywhere within a building was seen as most valuable. And the original 802.11 standard proved quickly to be too slow.

Wireless networking really took off after September 1999, when the IEEE approved both the 802.11b and 802.11a standards. Although slower, 802.11b was easier to implement than 802.11a, so 802.11b products began appearing in early 2000. Walls, interference from other 2.4GHz devices, and even atmospheric conditions can affect both the strength and range of an 802.11 signal (See the "When 11Mbps Isn't 11Mbps" sidebar), but in most cases it emits the radio signal in a sphere with a radius of between 100 and 150 feet. This is enough to cover most home environments. By spreading a

Next-Gen Phone Networks

Where does all this WLAN action leave the cell phone industry, which years ago was thought to be the most likely wireless access point to the Web? It looks as if 802.11b/a might supplant that industry's highly hyped, still undelivered high-speed 3G (which stands for third generation).

Although 3G is supposed to offer high-speed cell phone Web access, it has proven to be expensive and slow to implement, and it is not as robust a platform as Wi-Fi. As a result, a number of phone wireless companies are exploring 802.11x strategies, in which cell phones or voice-enabled PDAs would be able to roam the airwaves for available Wi-Fi hot spots and move from slower 3G connections to faster WLAN connections whenever the Wi-Fi signal is available.

series of additional access points (radio receivers/transmitters) throughout a larger office space or multiple floors, many businesses now extend their network's WLAN to reach throughout large buildings.

802.11b's popularity. 802.11b requires only two or more wireless NIC cards and an access point for transmitting signals to the adapters. A wireless Internet gateway lets multiple users share a single broadband connection. You can get all of this for less than $200; the sheer affordability of 802.11b has secured it as the de facto standard in the home and office.

Interoperability has been another of the keys to 802.11b's meteoric rise to business and home ubiquity. The WECA (Wireless Ethernet Compatibility Alliance) is a group formed to test and certify networking hardware from different manufacturers to ensure that they are compatible with one another. It officially dubbed 802.11b Wi-Fi (Wireless Fidelity), and any hardware bearing the WECA insignia will work with any other Wi-Fi hardware, whatever the manufacturer. This assurance of compatibility has gone a long way in making home and business users comfortable buying into the technology. Likewise, Microsoft has helped accelerate Wi-Fi acceptance by building support for configuring and adjusting wireless connections into Windows XP.

More than anything else, making a high-speed Internet connection available throughout a home or small office has been the driving force behind 802.11b adoption. This protocol is the undisputed king of the hill now and for the foreseeable future. It quickly supplanted an earlier HomeRF WLAN standard (which had a top bandwidth of about 2Mbps) and is responsible for more than 80% of all WLAN sales in the business sector, according to a Microsoft survey. Many colleges and office complexes now have "campus LANs" that use multiple access points to extend network access wirelessly across multiple buildings and outdoors. The retail world is embracing Wi-Fi because it lets cash registers and inventory managers send data directly to a store's network without the cost and inconvenience of wiring a building or waiting for handheld scanners and PDAs to be docked with a networked PC.

"A" Comes After "B"?

The 802.11b protocol may be wildly popular, but it also poses substantial security concerns over how to keep Wi-Fi eavesdroppers and panhandlers out. It is also not always fast enough for high-use offices. So the IEEE also ratified the 802.11a protocol. Now dubbed Wi-Fi 5, it is a much faster (54Mbps) approach that can also handle many more users than the 802.11b standard without conflict. In this case, B came before A, only because manufacturers implemented the 802.11b standard first, but both were ratified simultaneously.

Wi-Fi 5 is named after its use of the 5GHz radio frequency band, which is also unlicensed but can deliver four times the data bandwidth of 802.11b. But because the two protocols use different radio bands and even different techniques for securing and maintaining connections between access points, the upcoming 802.11a standard will not be compatible with existing 802.11b equipment.

802.11a is so fast that network hardware giant Cisco recently demonstrated its ability to send an HDTV-quality signal wirelessly to a Sony flat-panel Digital screen. One possible use for 802.11a would be as a multimedia network for the home with the ability to transmit DVD video to any monitor or desktop PC screen in the home.

Bumps in the road. Unlike 802.11b, 802.11a uses OFDM (Orthogonal Frequency Division Multiplexing) to send its signals, a more complex transmission approach that has distinct advantages and disadvantages. On the plus side, OFDM offers enhanced speed, and it also may be better for large business environments because it has more nonoverlapping radio channels than 802.11b, so it can handle many more users simultaneously without conflict. But it suffers from a lack of compatibility with the existing 802.11b standard, and the price for this added speed and flexibility is limited radio range. Although no hard specs are available yet about how far these signals will reach in a

Guerilla Wireless: Free Or Fee?

The ubiquity of the Wi-Fi standards has also given rise to a remarkable subculture of people who promote wireless access in public places. (See "Wireless Guerrilla Networks" on page 78 of the April *CPU*.) With the right placement of access points and amplified or directional antennae, 802.11b signals are already being projected into many public places in New York, Seattle, San Francisco, and other cities around the world so that anyone with a Wi-Fi notebook can tap into these shared broadband connections. These hot spots usually use the default channel and SSID (Server Set Identifier) settings of most Wi-Fi setups.

With so much Wi-Fi in the air, an entire class of hobo-like "war drivers" now scour neighborhoods in search of hot spots into which they can tap. In a new trend called "war chalking," these panhandlers mark the pavement with symbols to indicate the location and strength of nearby Wi-Fi signals.

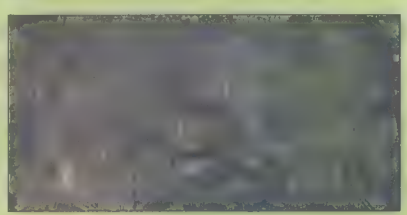
The prospect of cracking open one's notebook in any airport or park, tapping into a Wi-Fi hot spot, and checking email or the Web is so compelling that a number of startups such as Boingo Wireless and existing telcos are trying to design fee-based WLANs that let people tap into 802.11b LANs in public places. VoiceStream Wireless already provides 537 hot spots, usually in airports and Starbucks coffee shops, but it plans to have 2,000 hot spots by the end of 2002.

Going The Distance

Craig Bartell has been a network hacker since he got an Atari 400 with a tape drive and 300-baud modem in 1982. He currently spends his days at Sprint engineering networks using ADSL, ATM, IP, VoIP, VoATM, VoDSL, MGCP, H.248, OC-3c, and every other network acronym. Not getting enough of networks during the day, Craig retires to his basement in the evening to research solutions to the world's networking problems one link at a time. Here he shares with us how he built a long-distance Wi-Fi bridge using off-the-shelf parts so he could share a broadband connection 4.3 miles away. You can network with Craig at home@craig-bartell.com.

You've seen Wi-Fi used to connect two computers a couple hundred feet apart. How about connecting two computers 23,000 feet apart? There is less difference between the two than you would think.

Desperate for an Internet connection faster than dial-up, I came up with the idea to hook into a friend's network just more than 4 miles away using Wi-Fi. Being the engineer I am, I soon had pages of diagrams and equations spewed across my basement floor. After days hunched over maps, graphs, and a calculator with a worn down battery, I came to the sudden realization that it really wasn't that complex. Using two off-the-shelf Linksys WAP11s and a pair of 2-foot parabolic antennas, I was able to create a wireless network between two locations just more than 4 miles apart.



Connect the red dots in this aerial photo to see the path between the two connection points 4.3 miles apart.

Use The Focus

Surprisingly, the secret to going extreme distances with Wi-Fi isn't how much power the radio can output. Rather, it's how well the power is focused. It's kind of like cupping your hands around your mouth when yelling so someone can hear you from farther away. Cupping your hands doesn't make you yell any louder; it just focuses your voice in one direction. Directional antennas work in much same way.

The standard antenna that comes with a Wi-Fi device is designed to broadcast its signal in all directions. If there were nothing to interfere with the signal, it would expand out in the shape of a big ball. With the signal transmitting in all directions, it gets very weak after only a couple of hundred feet.

Here is a view of the antenna. I disassembled the WAP11 and put the electronics in the section of 4-inch PVC pipe behind the antenna.

You can see the 21dB-gain antenna mounted on the house and ready to go.

real-world environment, experts expect that hardware using 802.11a will require more access points at more frequent intervals to equal the reach of 802.11b.

Compatibility and range limits are only some of the reasons 802.11a has been slow to roll out, however. Expected to storm the market in 2002 because of its superior speed and flexibility, it stalled when the key chipmakers failed to achieve expected chip yields. Moreover, in a wireless world enamored with 802.11b, there was little immediate demand for the new technology. Finally, initial reports suggest that this standard is still struggling with an interoperability problem: cards and access points from one vendor not always working properly with those from another.

Interoperability was key to the success of 802.11b, so until WECA releases and tests enough 802.11a products for compatibility, this standard continues to register a vote of no confidence. According to a survey of first-quarter wireless sales by Dell'Oro Group, 802.11a products produced only 1% of revenue for the industry. Most analysts now say that this standard will only take hold when manufacturers begin distributing dual-mode wireless NICs and access points that will handle both 802.11a and 802.11b at once.

Meanwhile, the assigning of the Wi-Fi 5 name by WECA did give 802.11a one minor marketing boost. Once enough samples of the technology come into the market, WECA will test and assign this new seal of approval to Wi-Fi 5 devices that work properly with others from different manufacturers.

"G" Whiz

Then there's the 802.11g protocol, which is an upgrade to the 802.11b standard and is designed to be backward-compatible with old equipment. Ironically, this is the protocol that the IEE has yet to officially ratify, and consumers probably won't see any 802.11g products until 2003. The 802.11g approach is a compromise between the two existing protocols. It adopts the faster OFDM transmission scheme of 802.11a to deliver 54Mbps of bandwidth but stays within the same 2.4GHz radio band as 802.11b and can accept the DSSS transmissions of 802.11b equipment. Although you will need 802.11g cards, gateways, and access points to take advantage of the higher speeds, this same new equipment will be able to transmit and receive signals with the old

This is a view from my house toward the other end of the connection. The far end is just out of visual range somewhere in the middle of the picture.

The 21dB gain antenna is mounted at my friend's network 4.3 miles away.

When moving around the house with a portable PC, you want the signal to transmit everywhere because you never know where you will need it.

What if you want to network two computers that will never move? In network jargon, this setup is called a fixed point-to-point connection. In a fixed point-to-point connection, you know exactly where you want to transmit the signal. If you're getting ready to cup your hands around the antenna on your access point, you have the right idea. What you need is a directional antenna.

A directional antenna focuses the signal into a narrow beam. This ability to focus the signal is measured in decibels (dB). The higher the dB gain of an antenna, the more focused the signal becomes. The 21dB-gain antenna I used at both sides of the connection focused the signal into a narrow 10-degrees-wide beam.

Get In The Zone

Now that the signal is focused, it can travel long distances. One drawback of a focused signal is that it has difficulty penetrating walls or other obstacles. This means you have to make sure the path between the two antennas is free from obstructions.

Making sure the signal is free from obstructions is just a little more complex than making sure you have visual line of site. When microwaves travel between two locations, they bow outward as they travel. To visualize this, think of the path between the two antennas as a long garden hose. Now picture the hose starting to bulge, getting fattest in the middle. This "bulging" path the microwaves use to travel from point to point is called the Fresnel (pronounced fray-nel) zone. For my 23,000-foot link, the Fresnel zone had a diameter of 70 feet at its widest point. Fortunately, the house is on a hill, so the lowest portion of this microwave bulge was still 100 feet above the farmland in the valley.

A Pigtail?

If you are already ready to click the checkout button to purchase your new high-gain directional antenna, hold on: You will need to add one more thing to the shopping cart. You need a pigtail. The problem is that your antenna won't connect directly to your wireless access point. Most 802.11b access points (Aironet, Cisco, Linksys, Proxim, and SMC) have a RP-TNC female connector, while most antennas use an N male connector. A pigtail is usually 2 to 4 feet long and is used to convert one type of connector to another. Check the manual that came with your 802.11b radio to verify what type of connector it has.

Wi-Fi works wonderfully over long ranges. Because the DSL connection I was going to share was fairly slow, I only tested the wireless link at the 5.5Mbps setting. Pings averaged about 2ms with no packet loss, and throughput measurements showed about 2.5Mbps of available bandwidth. These are just about the same results I got when the two WAP11s were only a couple of feet apart.

by Craig Bartell

802.11b cards and access points at their original 11Mbps speeds.

Members of the IEEE task force for 802.11g were haggling over final details about the protocol through the end of 2001, so we have no final ratification of an 802.11g standard. If and when products do roll out, this protocol is well-positioned to appeal to home users and even fuel a new generation of home network products. Even though the practical, realized speeds of 802.11g will be far less than 54Mbps, it should be enough to transfer substantial video streams from the Web to a television or digital video recorder or even handle voice data for IP telephones and intercoms.

Alphabet Soup

Expect to see even more IEEE standards emerge. The 802.15.1 protocol is aimed at the Bluetooth spec. Unlike a WLAN, these WPANs (wide personal area networks) connect two devices directly to one another rather than into a multiuser network. Once the darling of wireless fans, Bluetooth failed to take hold as expected, especially because the cheap and easy 802.11b approach supplanted it in many people's minds. The IEEE standard will ensure that Bluetooth devices run in the same 2.4GHz radio band as 802.11b without their devices interfering with one another.

The IEEE also has task groups working on the "E" revision of 802.11. Although two or more years out, this protocol will enforce higher security measures and QoS (Quality of Service). Best of all, the task group is trying to make it backward-compatible with the existing 802.11b and 802.11a standards. The QoS part of the standard will let WLANs specify the amount of bandwidth that is guaranteed for different types of voice and video streams. This will make wireless video streaming (even via high-definition televisions) and IP telephony more practical because those streams won't suffer when greater demands are put on other parts of the network bandwidth. Far-sighted vendors of home automation and VoIP services have their eye on this protocol because it has the potential to put a home's voice, television, audio, and data onto a single network. Imagine your phone calls, pay-per-view video, broadband connection, and even music system wafting through the air on a single network that is usable from any room of the house.

But wait, there are more letters. IEEE has numerous task groups working on security,

compatibility, and global compliance requirements. The 802.11h protocol will add specifications for using the 5GHz radio band in accordance with European regulatory requirements. Meanwhile, 802.11i will enhance what is called "Medium Access Control," which will improve the security and user-authentication schemes for wireless. Further out, there will be follow-ups to the 802.15.1 WPAN specs, currently labeled TG2, TG3, and TG4. In addition to further helping Bluetooth play nicely with Wi-Fi, these protocols call for WPANs to work at 20Mbps and higher, as well as much slower rates in order to preserve appliance batteries for months or years.

A Wireless Future

Whatever standards dominate in offices and homes in the next few years, the wireless peripheral industry is chomping at the bit to expand the range of uses for Wi-Fi, Wi-Fi 5, 802.11g, or any successors that catch on. Moving files and sharing a broadband connection is only the beginning for wireless, which promises to put both the desktop PC and the Internet at the center of our lives.

In the office world, WLANs are likely to carry pager signals, intercoms, and even phone traffic. The VoIP industry believes that Wi-Fi is going to be the missing piece that makes Wi-Fi telephony, as it is called, click with companies. Upcoming NICs for notebooks and voice-enabled PDAs will be called "802.11/cellular multimode devices," because they can dial up any other phone anywhere using either the Internet or cellular networks for transferring data or voice.

And as bandwidth increases, expect to see wireless networks connect various entertainment units throughout the home. Listman Home Technologies (www.listmanhome.com) has designed a suite of programs and hubs that use wireless networks to run automated home tasks and interconnect stereos, televisions, and PCs. You will be able to catalog your CD collection on your PC or run video and audio tracks from the PC on your television and stereo. High-speed WLANs would be one way of streaming Internet-based VOD (video-on-demand) services to your family room television. WLAN-enabled MP3 players, Web cams, PDAs, and gaming console adaptors are already in development. The basic wireless technology that is emerging now is at the center of most visions for the connected and automated home.

The wireless dream began last decade on the promise of eliminating the growing spaghetti plate of wires growing behind our ever more complex PCs. In short order, a wireless dream has morphed into a mobility dream, the ability to access and move virtually any kind of data, media, or even voice communications to wherever we want them. CPU

by Steve Smith

See www.smartcomputing.com/cpumag/sep02/wireless for information on how the wireless revolution is affecting PDAs and the lowdown on when 11Mbps isn't really 11Mbps.

What's HOT, What's not

Hot
Wi-Fi
The 802.11b standard has taken the market by storm, responsible for more than 80% of wireless hardware now sold.

Not
Wi-Fi 5
Faster than 802.11b but much slower to take hold, 802.11a still waits for compatibility among devices and dual-mode support for legacy 802.11b hardware.

Hot
Wireless Gateways
Sharing a broadband connection has become the single best reason to get Wi-Fi. Your wife and children may even start talking to you again when you decide to share your high-speed access.

Not
802.11g
This supposed speed hike for Wi-Fi is mired in arguments among hardware manufacturers and standards groups over the final state of the standard. We may see 802.11g in 2003 if everyone can just get along.

Hot
Notebook Wireless
Who says you can't bring the Internet into the bathroom?

Not
VoIP
Voice over IP (telephony) remains a technological revolution still searching for an army to follow it.

Hot
Public Wi-Fi
Whether it turns out to be free or fee-based, having the capability to crack open that notebook in a town park, airport, or coffee shop and pulling broadband out of the ether is just too cool for words.

Not
Cellular Web Access
Let the Japanese and Europeans play with WAP-enabled and 3G cell phones that give you the Web on a 1-inch screen. Here in the good old U-S-of-A, we like our steaks, our professional wrestlers, our SUVs, our French fries, and our displays super-sized.

GET ETHEREAL

We Test A Whole Messa' Wireless Routers

If the previous networking articles in this section have you stoked to cut your cables and go wireless, here is a brief look at what is on the store shelves. Basically, your choices are 802.11b (WiFi) equipment with maximum speeds of 11Mbps or 22Mbps and relatively long range, and 802.11a gear, which tops out at 54Mbps or 72Mbps with shorter range. You can expect to see real-data transfers of about half these top speeds.

Wireless network gear ranges from simple access points, which let your existing network or PC communicate with compatible mobile devices, to combination access points/broadband modems/firewalls/multiport switches. We threw a few of each type into the mix, along with 802.11b and 802.11a standards, to give you an idea of just what your cash will buy you. Also, you should know that 802.11b and 802.11a are mutually incompatible, although Intel and others sell wireless equipment that accommodates both.

How We Tested

It's kind of dicey "testing" any wireless access point or router. Besides subjective analyses of ease of setup and use, about the only empirical test we thought proper was timing file transfers at different distances and under different conditions.

We marked four points inside our building, two at 150 feet and two at 250 feet. One set was across an unwalled, relatively open office space, obstructed only by computer monitors and a few skulls of varying densities. (Funny, there seemed to be a considerable gravitational well around the Insidious One's desk . . .) We made the other 150-foot and 250-foot marks in our building's warehouse area, making sure to get plenty of structural steel beams, walls, huge paper rolls, and equipment in the way.

We transferred a 100MB folder of mixed file types from our test PC's hard drive to each wireless access point by CAT 5e Ethernet cable, and thence to each PC Card adapter and a notebook's hard drive. We placed each of our access points 4 feet above ground level. The PC's and notebook's hard drives were faster than even 72Mbps 802.11a, so our file-transfer times should reflect each access point/adapter combo relatively fairly. We couldn't control the interference from atmospheric conditions, although we made sure no one was using the microwave ovens during testing.

Our base PC for the access points was an IBM desktop with a 667MHz PIII, 192MB of SDRAM, an IBM 10/100Mbps EtherJet PCI network card, and XP Home. It also had a 15GB 7,200rpm IBM Deskstar 75GXP hard drive. Our receiving notebook was an IBM ThinkPad T30 with a 1.8GHz Pentium 4-M, 256MB of PC2100 DDR-SDRAM, and a 40GB 5,400rpm Toshiba MK4019GAX hard drive.

Working Without Wires

We transferred a 100MB folder of mixed file types from our test PC's hard drive to a notebook's hard drive, using each of the following routers. We used each manufacturer's PC Card adapter except where noted.

	Open Office Space		Obstructed Office Space	
Router	**150 feet**	**250 feet**	**150 feet**	**250 feet**
D-Link AirPlus DI-614+ 802.11b	3:02	3:10	4:33	No Signal
HP hn200w 802.11b *	4:24	4:26	6:33	No Signal
Netgear HE102 802.11a	1:24	1:44	2:19	2:57
SMC EZ Connect 802.11a	1:23	No Signal	No Signal	No Signal
Trendnet TEW-211BRP 11Mbps Wireless Access Point/4-Port Switch *	5:22	5:29	5:22	7:21
U.S. Robotics USR8011 802.11b *	3:00	2:59	3:00	11:37

* Tested with D-Link adapter

We used each manufacturer's PC Card adapters as provided, but we had to reuse the D-Link card to test the 802.11b Trendware, U.S. Robotics, and HP access points. (To read our reviews of the HP hn200w 802.11b and the Trendware Trendnet TEW-211BRP, go to www.smartcomputing.com/cpumag/sep02/routers.)

All the access points we tested performed faster at closer range and should have greater ranges outdoors. In fact, our closest test point, 150 feet, was too far for most of these units to hit their top speeds. Our distance tests (especially considering our steel and concrete obstructions) are really more applicable to business settings than home environments. In other words, you might enjoy top speeds from a short-range 802.11a router throughout your home.

D-Link AirPlus DI-614+ 802.11b

The "Plus" part of the AirPlus DI-614+ 802.11b router refers to technology that lets it hit a theoretical max transfer rate of 22Mbps instead of 11Mbps. Optional PBCC (Packet Binary Convolutional Coding) modulation, provided by Texas Instruments silicon, is part of the reason behind the performance boost. Still, D-Link says, the DI-614+'s higher speed shouldn't diminish its compatibility with existing 802.11b networks, which is good news. Like other wireless access points, the router drops its transfer rate to 11Mbps, 5.5Mbps, and slower speeds the more distance you place between it and the receiving adapter card.

The DI-614+ simply adds wireless connectivity to an already impressive gateway router/four-port switch. It's also a cable/DSL modem, allowing broadband Internet sharing across your network with DHCP IP addressing and a NAT firewall.

The router's browser-based setup is as easy to use as other D-Link models. Its remote-management options include sending traffic logs to an email account, for example. It can also use up to 256-bit WEP encryption and handle multiple IPSec, PPTP, L2TP sessions with VPN passthrough. There are also simple parental control options, such as domain blocking and IP, MAC, and URL filtering.

I tested the DI-614+ with a D-Link DWL-650+ PC Card adapter ($89). Among the four 802.11b routers, this D-Link finished second in our speed tests behind the U.S. Robotics USR8011. The DI-614+ held tight in our Open Office Space competition, transferring a 100MB folder in 3:02 at 150 feet and 3:10 at 250 feet. It fell behind the U.S. Robotics unit in the Obstructed Office Space test. Pushing through steel-studded walls and sundry equipment, the D-Link charted a 4:33 transfer at 150 feet but couldn't get a signal at 250 feet.

The DI-614+ has drivers available for Win95/98/Me/2000/NT/XP, plus unnamed versions of Mac OS, Linux, Unix, and Novell. It comes with a short CAT 5 cable and manual on CD. U.S. customers get a 3-year warranty and 24/7 toll-free phone tech support for that time at (800) 758-5489.

AirPlus DI-614+
$149.00
D-Link
(800) 326-1688 (949) 788-0805
www.dlink.com

Netgear HE102 802.11a

The HE102 is the power user's choice in this roundup—if you use Windows. The HE102 is just an access point, not a multiport switch/firewall/broadband modem. Still, it was the fastest option for adding hot wireless capability to our existing network. It even outdistanced half the 802.11b kits in an obstructed setting.

This router has a 54Mbps nominal top speed, with a turbo mode of 72Mbps, translating to 9MBps, or perhaps less than 5MBps in the real world. It supports up to 152-bit WEP encryption to keep your network more secure than a bare 802.11a setup and has a 9-pin serial port, which Netgear says has no end-user function.

This unit was faster (2:57) at 250 feet through heavy obstructions than any 802.11b router was at 150 feet in an open space. Unlike the SMC, the Netgear finished all its races. It took a 1-second back seat to the SMC at 1:24 at 150 feet in our Open Office Space trial but got its own back with a 1:44 transfer at 250 feet. At 150 feet in our Obstructed Office Space test, it still pumped 100MB in 2:19.

I tested the unit with a Netgear HA501 PC Card adapter ($184). The AP costs $427 at Netgear's online store. The router supports Win98/Me/NT4/2000/XP but nothing else. It comes with a printed users guide, a 25-foot CAT 5 cable, and two small wall mollies for vertical mounting. The HE102 has a 5-year warranty (two years on the power supply), with 24/7 toll-free phone tech support for the 5 years.

HE102
$427
Netgear
(888) 638-4327 (408) 907-8000
www.netgear.com

SMC EZ Connect SMC2755W 802.11a

This early 802.11a offering from SMC has an attractively curved plastic design but the same Popsicle-stick antennas as the Netgear HE102. Also like the Netgear, the EZ Connect is a Windows-only access point with a 72Mbps turbo mode (54Mbps maximum without turbo mode) and up to 152-bit WEP. Alas, the similarities end there.

If HP's hn200w hit an ease-of-setup home run in our tests, SMC swung at air three times, then accidentally let go of the bat. The router is really made to connect to an existing router or hub, as it requires a device with a static IP address before you can set it up. Trying to set it up connected to a node PC on our testing labs' LAN gave us fits until we tried a crossover cable (not included). We also had to force the SMC's SMC2735W PC Card adapter ($159.99) to connect to the SSID (Service Set Identification) labeled "Any," as it didn't automatically recognize the access point on its own. Including a crossover cable or serial setup cable and port would help users who just want to network a PC and a notebook without buying a hub or switch.

I wish I could say there was a silver lining to the setup hassle, but there wasn't. The SMC2755W looked great at 150 feet in the open air, just edging out the Netgear HE102 with a 1:23 transfer time. Unfortunately, it went south in a hurry, failing to even maintain a signal over 250 feet in our Open Office Space test, let alone connect at either distance in our Obstructed Office Space environment. Normally, switching wireless channels saves the day, but not in this case. I was even using an SMC PC Card that is tailor-made for the thing. Chalk up the SMC2755W's disappointing performance to its first-gen status, proving yet again that early adopters should watch for little quirks in the first models to market.

Like the 802.11a Netgear, the wall-mountable SMC2755W is limited to Win98/Me/NT/2000/XP. It has a limited-lifetime warranty and comes with 24-hour phone tech support in North America, which I have a feeling you may need, power user or not.

EZ Connect SMC2755W

$ $399.99
SMC
(800) 762-4968
949-679-8000
www.smc.com

U.S. Robotics USR8011 802.11b

The 11Mbps USR8011 isn't U.S. Robotics' newest or flashiest wireless kit, but it's a great medium-range performer. However, some of its features and its tech support lag behind the pack.

This wall-mountable 802.11b access point is also a broadband router for cable or DSL, a firewall, and a three-port switch. It has a functional 9-pin serial port, which offers failover protection to an ISDN or dial-up connection in case you lose your broadband pipe. The USR8011 even has a parallel port, so it can act as a print server (under Windows only).

Setup was pretty easy. The USR8011 allows VPN pass-through for PPTP and IPSec sessions and supports WEP encryption up to 128-bit strength, which trails behind the 152-bit and 256-bit strengths of its competition here.

Even using D-Link's PC Card, the USR8011 beat the D-Link router in both speed and distance. In fact, this router was the fastest 802.11b access point in all tests but the Obstructed Office Space competition at 250 feet, where its 11:37 time fell behind the Trendware Trendnet TEW-211BRP's 7:21. In the Open Office Space tests, the U.S. Robotics unit hit 3:00 at 150 feet and 2:59 at 250 feet. It finished the Obstructed Office 150-feet race with an even more impressive 3:00.

The USR8011 comes with a 2-year limited warranty, CAT 5 cable, and installation leaflet, 20-page setup manual, and users guide on CD. The router supports Win95 or later and Mac OS 8.5 and later. Unlike the other brands here, however, U.S. Robotics' phone tech support is only available during business hours at (801) 401-1143. Don't miss U.S. Robotics' new 22Mbps models at www.usr.com.

USR8011

$ $179.99
U.S. Robotics
(877) 710-0884
(866) 287-7669
www.usr.com

Something In The Air

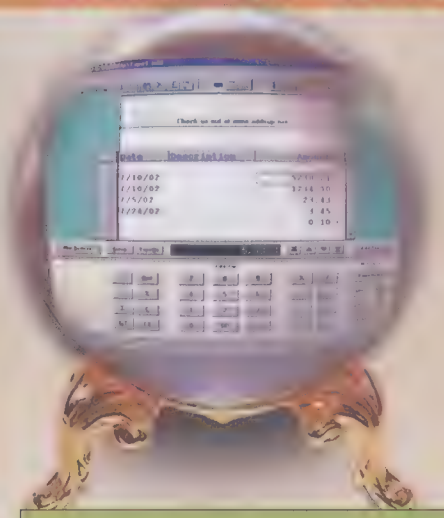
If you're a performance addict with an existing network, put the Netgear HE102 at the top of your "possibles" list. If price or compatibility with the status quo steers you toward 802.11b, explore the U.S. Robotics USR8011 or D-Link AirPlus DI-614+. Finally, consider a router that supports both 802.11b and 802.11a, such as Intel's PRO/Wireless 5000 LAN Dual Access Point, which we unfortunately were unable to get in for testing before press time. CPU

by Marty Sems

The Bleeding Edge Of Software

Inside The World Of Betas

by Warren Ernst



Fortune-telling becomes an exact science when it comes to working with betas. This month we bring you four glimpses into the future of software.

AddsUp 4.5 Beta

Official product name: AddsUp
Version # previewed: 4.5 Beta
Publisher: AddsUp
Developer and URL: AddsUp; www.addsup.net
ETA: Q3 2002
Why you should care: Adding and subtracting has never been as complete.

Some mathematical jobs are too small for Excel but too complicated for Calculator. For such jobs, consider AddsUp, now in beta 4.5. It is essentially a digital version of a traditional 10-key paper-tape adding machine.

Adding machines were (and are) so popular because the tape they use offers a quick summary of the numbers being calculated and serves as a record for later reference. AddsUp picks up where your father's adding machine leaves off by not only saving tapes on your computer but also providing templates for calculations you repeat often, such as balancing a checkbook. You can conveniently add or remove columns and add comments and add, edit, or remove items from tapes with the totals updating automatically. You can link tape totals into Word or Excel docs, with the totals changing as the tape changes. With Excel, AddsUp doesn't need to be open for OLE to work.

Other features include adding links to Web pages within tapes, changing tape and text colors, and adding company logos as headers that are suitable for giving to clients. There's also a Mortgage plug-in that handles interest and payment-schedule calculations. (Additional plug-ins are reportedly on the way.)

The beta didn't crash during my use, took up few resources, and comes with a thorough help file and complete uninstaller. AddsUp comes at several affordable price and feature points. The beta is the most full-featured free version available but terminates in 30 days. ▲

NetSwitcher 3.2.6 beta

Do you often use a notebook between several networks? Connect a desktop directly to a broadband modem and personal firewall or LAN? Occasionally switch from WiFi network to WiFi network with an 802.11a/b card? If so, you know the hassle of manually entering different IP addresses into various fields in various dialog boxes.

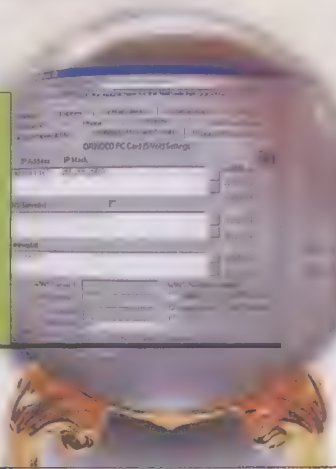
Enter NetSwitcher. It switches networks, or at least the network settings on your Windows computer. In short, it stores different sets of network settings by name, letting you easily select a set and then apply it. If the Windows version you use requires a reboot, NetSwitcher takes care of that, too, but in many cases you can just keep working.

This version stores different sets of startup apps, Microsoft Networking settings (such as Workgroup, Computer Name, etc.), Shared Folder or Volume settings, and modem settings for DUN. Serious travelers will love how NetSwitcher can automatically change SMTP email servers that Outlook, Outlook Express, or Eudora use—handy when your server thinks you're a remote spammer and shuts you out.

A new Taskbar icon can switch among stored settings with just two clicks and monitor your shutdowns and prompt you to switch settings for the *next* reboot.

This polished beta has good documentation and didn't hang or crash. At only $14 for a one-user/many-computer license, it's about the best utility deal out there. ▲

Official product name: NetSwitcher
Version # previewed: 3.2.6 beta
Publisher: J.W. Hance
Developer and URL: J.W. Hance; www.netswitcher.com
ETA: Q3 2002
Why you should care: LAN to LAN made easy.



Network File Monitor Professional 2.0.0.3 Beta

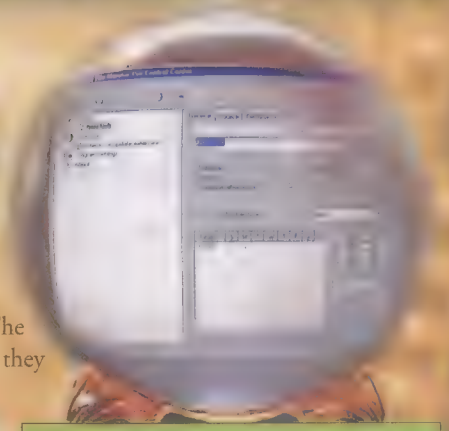
Network File Monitor Professional is a Swiss Army knife-like tool for network pros and advanced network hobbyists who need to keep track of many far-flung networked machines.

NFMP comes with two modules, Front End and Background Service. The two communicate via TCP/IP over the Internet or your LAN, using standard protocols and TCP/IP ports. Between them, you can copy, move, or synchronize files or folders, either on command or a regular schedule; check for free space on a specified drive; ping a server; and check for a message with a specific bit of text on an email server. You can also select filenames based on wildcards and change file and NTFS attributes remotely via HTTP, FTP, or POP3. So, clearing out ports through a firewall is no different than setting up a conventional server.

When the Front End does something unattended, it can report results several ways, including from a Novell notification, an email sent directly to a mail server via POP3, or an ICQ instant message or SMS text message. Front End also generates logs in plain text and HTML when instant information isn't necessary.

Using NFMP is a little daunting. The dialog boxes are well laid out but offer little in the way of prompts or Wizard buttons. The Help file is full of steps and procedures, but they are extremely wordy and lack bulleted or numbered steps. Over time you'll probably zip through these screens quickly, but new users are likely to be confused.

Despite the learning curve and getting through firewalls, NFMP ran without a hitch, consuming few resources and never crashing. The app may be the ticket for system administrators who constantly run from machine to machine or for those just wanting to check their home computers from work. ▲



Official product name: Network File Monitor Professional
Version # previewed: 2.0.0.3 Beta
Publisher: Ascella Area Runes Software
Developer and URL: Ascella Area Runes Software; www.aarsoftware.com
ETA: Q3 2002
Why you should care: Easily tracking remote servers is every administrator's dream.

SpamNet Beta 3

Who says you can't harness peer-to-peer networking schemes for the power of good? Cloudmark's SpamNet seems to know the secret to killing spam: group collaboration.

SpamNet works by installing into Outlook 2000 and XP as a module. It reads your incoming email, assigning a key code to each message based on subject and originator information. It then will compare a message's keys to keys it collects from the SpamNet central server. If there's a match, the application automatically sends the spam to a Spam folder in Outlook. Nothing is automatically deleted, and no message information is sent on to Cloudmark.

Cloudmark gets its spam information from you by installing toolbar Block and Unblock buttons into Outlook. If you receive spam, highlight it and click Block. The message goes to your Spam folder and the key to Cloudmark. When enough users tag the same message, it's filtered automatically. If a message in the Spam folder isn't spam, highlight it and click Unblock. This sends it to your Inbox and sends the key to Cloudmark. If enough users mark it as not being spam, it stops getting blocked.

Cloudmark says it kills more than 75% of the spam you receive, and I'd say that's pretty close. If you use a dial-up connection, the key transfers seem to take a few moments, but broadband users won't notice a thing. SpamNet only works with Outlook 2000 and XP for now, but it's expected to work with Outlook Express in the near future and possibly other clients in the far future. However, SpamNet doesn't work where it's perhaps needed most: Hotmail and Yahoo! Mail Web sites.

It's unclear how Cloudmark will make money (eventual charges seem likely). What is clear is that SpamNet seems to be the best spam killer out there. ▲

Official product name: SpamNet
Version # previewed: Beta 3
Publisher: Cloudmark
Developer and URL: Cloudmark; www.cloudmark.com
ETA: Q4 2002
Why you should care: Maybe the best way to control spam.

Send Us Your Betas

Know of software in the beta stage that's deserving of some attention? Let us know. We'll take a look at it and possibly give it a go-around. Send your prospects to bleedingedge@cpumag.com.

(For previews of Beonex Communicator 0.8 and K-Meleon 0.6, see www.smartcomputing.com/cpumag/sep02/betas.)

Got Linux?

We Dissect The Top Distros

Why stick with vanilla when there are so many flavors of operating systems out there? Whether you crave an OS that can suit your needs off the shelf or one you can precisely tailor, try Linux. Even if you don't want to become a Linux guru, you almost can't go wrong with a good commercial distro.

I tried commercial distros from leading publishers Caldera, Mandrake, Red Hat, and SuSE, plus downloaded ISO images and burned installation CDs to sample Debian, Slackware, and Lycoris. I learned again that you get what you pay for, as the commercial distros were much easier to install and configure.

To my delight, Mandrake and SuSE let me produce in minutes the configurations that have taken me hundreds of hours the past two years to set up. SuSE is my choice as the best all-around operating system. Mandrake was a close second, but no major distro was a real clunker.

Some distros I downloaded were disappointing, failing to even install in some cases. Does that mean they're bad? No. It just means I either did something wrong (repeatedly, and often something new every time) or my weird mix of high-end and bargain-basement components tripped up the installers.

Choosing & Testing

All Linux distros start with a Linux kernel, which manages the system's basic I/O functions. After that, almost anything goes. A full distro contains the kernel plus everything else that goes into a complete, modern OS.

DistroWatch.com lists about 90 different Linux distro projects. Of those, about one-tenth are discontinued or inactive, but fourscore distros provide a nice selection, with something for almost everyone (see our "Something For Everyone" and "United [Linux] We Stand" sidebars at www.smartcomputing.com/cpumag/sep02/linux).

Different distros may use different kernel versions, plus different package-management tools, installers, software packages, desktop environments, and system-management tools. Virtually all distros are available for download in some form to comply with the Linux kernel's GNU license. Commercial vendors can make these hard to find, but they're there.

For this roundup, I looked at leading distros to determine which are best suited for desktop use. Caldera, Mandrake, Red Hat, and SuSE—all commercial vendors who sent shrink-wrapped distros—all pitch product support as a main feature (most problems I encountered were with downloaded distros). Deluxe Linux versions generally include more server and commercial software, plus more support, so consider starting with a basic package before a professional or "powerpack" edition.

Considering the degree to which you can tweak Linux, performance testing is a minefield. I focused instead on installation and configuration, what the packages offer, special tools and features, and on subjective observations based on using each distro.

Testing took place on one of three systems, most on a home-brewed Athlon XP 1700+ with 500MB of RAM and a Matrox AGP video card, Intel Ethernet card, HP CD-RW drive, and a removeable bay for the primary master hard drive (the bay keeps a desktop safe while testing new software).

A backup system (essentially the same machine but with an Athlon XP 1400+ and bargain AGP video card)—meant to be a slightly less powerful version of my primary machine—failed me repeatedly when the video card turned bad. I installed an old PCI card instead, but none of the distros did particularly well on this system. My Sony VAIO PCG-F340 notebook proved even big commercial distros are usable on less than state-of-the-art systems.

I burned ISOs on the primary system, though not all images worked. Even with a broadband Internet connection, ISOs took from 1 to 3-plus hours to download; most Linux installations take at least half an hour to install and much longer if a substantial portion of the install is done over the Internet.

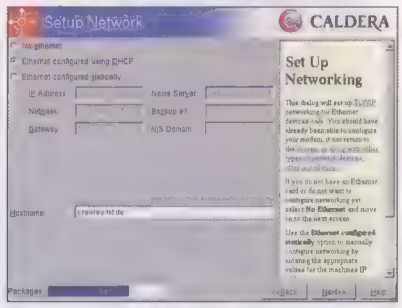
Overall, I recommend getting a good distro all on CD, even if you spend $200 or more. The cost is worth the time and energy you'll save downloading images, burning, testing, and reburning.

Shrink-Wrap Distros

The following reviews include the shrink-wrap distros I received from leading commercial vendors.

Caldera OpenLinux 3.1.1

It's funny how the distro with the scariest license agreement is also called



OpenLinux 3.1.1
$99
Caldera
www.caldera.com

"OpenLinux." It requires you to accept an imposing edocument to begin the

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

installation, and Caldera presents you with a security-printed "certificate of license and authenticity," reminding me of nothing so much as the Windows experience. However, I took a deep breath, continued, and the bad monster went away.

Although OpenLinux didn't like my home-brew PCs, it worked like a charm on my Sony VAIO notebook. With only a 366MHz Pentium II and 192MB of RAM, performance with KDE 2.2 seemed just as snappy as on my desktops. (KDE and GNOME are graphical desktop environments, defining user interfaces for things such as menu bars, window management, icons, and other tools under the X Window system).

Caldera's Lizard installer did the job on my notebook, but it doesn't offer much freedom of choice. The default installation is a dependable combination of KDE and K-oriented apps. For something else, your options are limited (no GNOME, for example), and you have to wade through an endless list to find what you want. Your desktop will be KDE, and you get XEmacs instead of GNU Emacs. KDE and XEmacs may be nice, but I prefer GNOME and Emacs. (Emacs and Vi are the big two in Unix text editing. Emacs is powerful and adaptable; Vi is fast and efficient. XEmacs is a graphical and [in my opinion] inferior version of Emacs.)

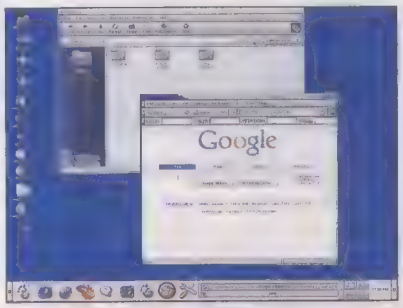
Though I wouldn't choose Caldera's distro for myself, it will work fine for corporate or casual users.

MandrakeSoft Mandrake Linux 8.2 PowerPack

If you never plan to use the Linux command line but want all the power and value of free software, try Mandrake. Installation is still step-by-step, but you can skip around with the DrakX installer. The hardware probe didn't do as well detecting my video card and monitor, but DrakX gave me more options for my display, including 15- and 16-bit colors.

Getting my configuration just right with LyX (a publishing application), GNOME, Emacs, Evolution, and other apps I use daily, took me weeks (maybe months). Like SuSE, Mandrake got me going in minutes.

Mandrake's development team seems to have thought of everything, including a very nice, functional submenu that lets you choose what you want to do. Instead of trying everything on a list of apps in hope of finding something appropriate, this menu lists functions (install new software, configure network connection, etc.) and walks you through processes with friendly wizards.



Mandrake Linux 8.2 PowerPack
$69
MandrakeSoft
www.mandrakelinux.com

Every time I use Mandrake, I find something new and useful, such as Mandrake Software Manager, a GUI front-end for RPM-package management. One window shows packages and package information. You can click tabs to choose installed or installable packages, click another to view packages by category or one alphabetized list, or click a package to install/remove. Beautiful.

Eye candy, plus ease of use, equals a very CPU-intensive GUI, and I experienced sloth-like, if not positively snail-like, response. Some tinkering should light a fire somewhere, but if you need the ease-of-use features, you may be reluctant to optimize.

Too bad MandrakeSoft didn't get a second opinion on its default desktop color theme. Hurlaceous (and I don't mean that in a good way) is the only way to describe the garish blue and orange hues that mar this otherwise fantastic distro.

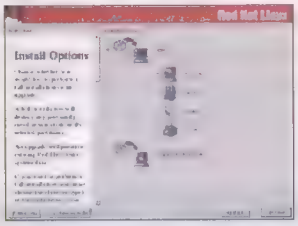
Between the performance issues and colors, Mandrake doesn't quite make it for me, but I'd be comfortable letting my sister take it home. I'll face the colors, however, to play the Sims in Mandrake's unique Gaming Edition, which hadn't reached 8.2 at press time.

Red Hat Linux 7.3 Personal

The old man of commercial Linux, Red Hat is getting dusty and battered. Sure, it's as good as ever, but RH 7.3 lags behind SuSE and Mandrake on package count, installation, and configuration.

Familiarity may breed contempt (I have every Red Hat distro from 5.0 on), but the 7.3 installation was persnickety, exiting abnormally more than once. Ultimately, it did deliver a complete and useable desktop. Red Hat's 7.x graphical installer was beautiful when it came out. It still does the job, but the package selection was less bounteous than those of its competitors.

Though it's a breeze compared to the early days, the RH 7.3 installer walks you



Linux 7.3 Personal
$59.95
Red Hat
www.redhat.com

through many steps one at a time. Pick a language and click. Set up your mouse and keyboard and click. Workstation, server, or custom? Click. You can navigate back and forth in the installer to make changes or corrections, and you can test everything or trust the installer's automation.

A Red Hat Alert Notification Tool lets you control kernel updates, plus all other apps on your system. Though similar to Ximian's Red Carpet update tracker, Red

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

Hat offers kernel patching, a big plus for busy sysadmins and regular users. An alert icon shows red (updates available), green (updating), or blue (all updated) and helps you stay current with security patches.

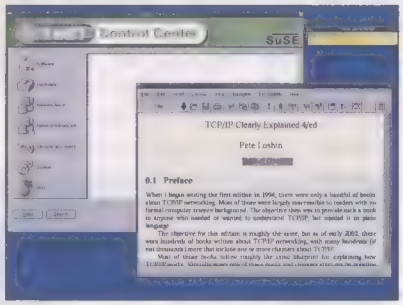
A lack of support for the up-and-coming ReiserFS (which is a journaling filesystem for improved reliability and stability) is surprising, but Red Hat 7.4 should change that. KDE 3.0 and GNOME 1.4 are supported, with GNOME 2.0 slated for version 7.4.

It's hard to go wrong with Red Hat. It has an experienced support organization, a huge community of self-taught and RH-certified sysadmins and Linux junkies, and many newsgroups and Web sites dedicated to answering, "How do I do [something] with Red Hat?" For this reason and more, RH 7.3 remains a reliable way to start with Linux.

SuSE Linux 8.0 Professional

Three clicks and you're good to go—kind of. SuSE offers a slick distro from Germany, and the comparisons to Teutonic engineering are inevitable. This distro is well worth the money. SuSE has included every package I've ever used or wanted to use, plus a few zillion more.

The SuSE YaST installer can do a serviceable install in three clicks—if you have no preferences about installed packages or disk partitioning. You can trust the hardware detection module, too. The result is a very usable KDE 3.0 desktop that's fine for starters.



Linux 8.0 Professional
$79.95
SuSE
www.suse.com

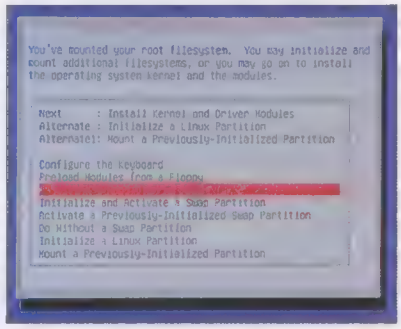
If you're particular, like me, you can still be happy with what's right out of the box. Choose general categories for packages (development, multimedia, etc.), and then narrow in on individual apps. One nice touch is a slide bar that lets you add or remove CPU-busting GUI features to optimize the eye candy-performance ratio.

Though not much of a problem, I wish SuSE included more of the installed applications on the GUI menus instead of forcing me to add them manually. The upside is that this led me to discover you can bring up the YaST installer from the desktop if you need to make changes in the original configuration.

SuSE is a clear winner, giving me a usable desktop out of the box. Even the wallpaper, windows, and color defaults are unobtrusive, yet functional. You can do a free FTP install over the Internet, reducing the need for massive downloading/burning efforts (and increasing the odds you'll spring for the commercial version). I have already started migrating my desktop.

Debian Linux (Not Ubuntu)

A Linux roundup wouldn't be complete without Debian and Lycoris (the

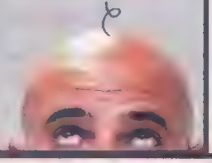


Debian Linux
Free
Debian
www.debian.org

Infinite Loop

How Much Will Fit On Your Locks?

Those tiny wires that your CPU uses to transmit information can be as thin as 0.13 microns. A micron is .0000394 inches, or approximately 1/25,000th of an inch. For comparison's sake, the average human hair is a whopping 50 microns in diameter. Being connoisseurs of interesting stats, we figured that a full head of hair includes around 140,000 strands. That would mean you could fit 53,900,000 of those tiny wires on a full head of hair. Of course, you'll lose around 385,000 of those wires each day.



The Leap To Linux

We gathered a collection of Linux distros that included commercial versions suitable for newer Linux users and downloadable, free versions more experienced users might favor. Here is how the distros break down.

	Caldera OpenLinux 3.1.1	Debian Linux 2.2 (Potato)/3.0 beta (Woody)
Company/ Project	Caldera	Debian
URL	www.caldera.com	www.debian.org
Price	$99	Free download (CD sets available from resellers)
Features	Linux for business; no retail channel	Tech cachet; free software only
Pros/Cons	Basic vanilla Linux configuration; few choices; high price	Thousands of packages; tough to install
CPUs	2	N/A

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

Lycoris amethyst build 45 (beta of Desktop/LX Linux)

$29.95
Lycoris
www.lycoris.com

Redmond Linux guys: Do you remember them?). These distros have gotten so much press I have to mention them. It's just too bad I wasn't able to successfully install either one.

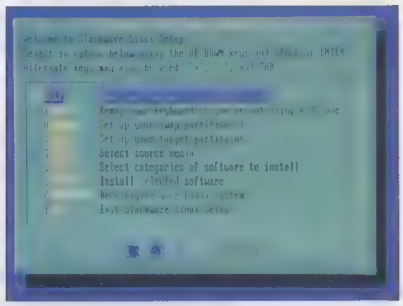
I really wanted to try Debian. It is free, and everyone loves it. Debian isn't selling anything, it invented packages (well, maybe the BSD people did that), and it's supposed to be the best. I downloaded the ISOs for the latest stable release (2.2v6, code-named "Potato") and the latest beta (3.0, code-named "Woody"), but I couldn't get beyond the text-only install.

Part of the problem, I think, is that once your basic system configuration is done (select keyboard, mouse, drive partitioning), you can only go forward. That's unfortunate because the trickiest part of installing Linux is getting the X Window system configured correctly, and Debian wants you to be quite specific (and quite accurate) when you are entering your the specifications for your monitor and graphics card.

Though I'm not cool enough to run Debian, my home-grown hardware may be too cool for Lycoris. Its build 45 beta version is supposedly nearly ready to ship, but you know how things are in Washington with deadlines. I tried build 44, as well, but couldn't manage to get past the Lycoris-branded Lizard installer (a good reason not to review beta software). Once Desktop/LX ships, I'll report back.

I did get Slackware to work, but when did these guys go commercial? Slackware is still tech-hip with a minimalist Web site and graphics-only installer. Unlike with Debian, I didn't get dumped out of the process when I hit a snag; it just dumped me back to where I was (or forward me to the next step).

On the plus side, I booted up a fresh system with my desktop of choice, as well as most of my favorite applications (including Evolution, Emacs, Gnumeric, and others). On the downside, however, Slackware didn't detect my notebook's



Slackware 8.1

$39.95
Slackware
www.slackware.com

sound card, and it doesn't bring many packages to the table, unless you're satisfied with the basic office productivity, Internet, and system tools that you can get anywhere.

Linux gurus swear by Slackware, so who am I to differ? The OS is fast and straightforward to install, and it ran the first time through. Though not as easy to use as, say, Mandrake, Slackware provides as stable a platform on which to run GNOME (or any other environment) as any distro.

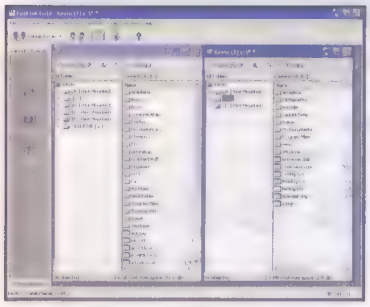
by Pete Loshin

Lycoris amethyst build 45 (beta of Desktop/LX Linux)	Mandrake Linux 8.2 PowerPack Edition	Red Hat Linux 7.3 Personal	Slackware Linux 8.1	SuSE Linux 8.0 Professional
Lycoris	MandrakeSoft	Red Hat	Slackware Linux	SuSE
www.lycoris.com	www.mandrakelinux.com	www.redhat.com	www.slackware.com	www.suse.com
$29.95	$69	$59.95	$39.95 (by subscription, $24.95 per release)	$79.95
Ultra easy to use	Super easy to use; available Gaming Edition	Strong support; good all-around distro	Super geeky; super stable	Powerful system utilities; easy to install and use; many apps to choose from
N/A	Incredibly user-friendly; incredibly ugly default colors	Solid and reliable; losing ground to competitors	Reliable and easy to use; stability means a less flashy, older look	Immediately usable; no cons
N/A	4	4	4	5

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

by Kevin Savetz

LapLink Gold 11



LapLink Gold 11
$179.95; $139.95 download
LapLink
www.laplink.com

LapLink Gold 11 is an excellent option for remote PC control and file transfers. Not only does the program let you connect two PCs via TCP/IP and modems, but it also supports connections via serial, parallel, and USB ports.

Wireless infrared and IPX networks round out LapLink's connectivity choices, many of which are useful only if your PCs are in the same room. If they are, however, LapLink provides tremendous flexibility in connecting them.

LapLink also includes numerous features that are well thought out. The app works even if one PC is behind a firewall, and Print Redirection lets you print a remote document on a local printer or print a local document on a remote printer. LapLink also includes a file transfer tool, an automatic file synchronization function, and chat via keyboard or voice. The package also bundles a light version of PowerQuest Drive Image for cloning hard drives.

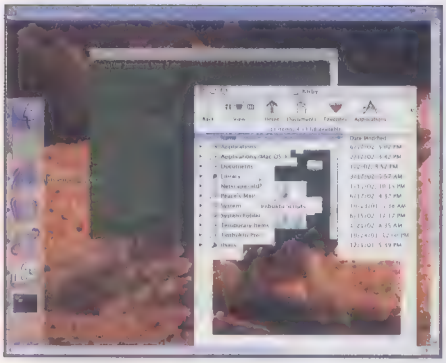
LapLink's only major downside is that unlike Timbuktu, GoToMyPC, and Virtual Network Computing, it's for Windows only (95 and later). You can use the SurfUp tool to make your PC's files remotely accessible from any computer with a Web browser, but you can only remotely control the PC from another PC running Windows.

If the PC you want to install on doesn't have a CD-ROM drive, LapLink can create a floppy-based installer or copy itself to the remote computer via serial cable. (The latter method didn't work on our Win95 system, however, citing a missing DLL.)

A downloadable version of LapLink costs $139.95. The $179.95 boxed version of the app includes serial and parallel cables for connecting PCs. A USB networking cable costs $20. Upgrading or sidegrading from a competing product is $109.95.

LapLink Gold 11 beats Timbuktu Pro hands down for connectivity options and extra features. If you only need to access your PC using Windows, LapLink could be worth its weight in gold.

Netopia Timbuktu Pro 5.0



Timbuktu Pro 5.0
$169.95; Twin Pack
$209.95; Multiplatform Pack
Netopia
www.netopia.com

Timbuktu Pro 5.0 also lets you access a remote PC via a dial-up modem or any TCP/IP connection, including a LAN or the Internet. The app also supports file exchange. For example, you can copy files from the remote PC's hard drive to your local PC. A two-pane window that shows the local and remote computers lets you simply drag files or directories from one pane to the other to copy them. You can also chat, instant message style, or use an intercom function to speak via a mic.

Timbuktu is available for both Windows (98 and higher) and Mac OS (8 through X). With the Multiplatform Pack ($179.95 download), you can control a Mac from a Windows machine, or vice versa. A Twin Pack ($139.95 download) lets you control one Windows PC from another. The program's Windows and Mac OS X interfaces are just different enough, however, to be disturbing when switching between the two.

Control of a remote host over a LAN connection is fast and responsive. Graphical glitches (whenever windows appeared or were moved) were a constant annoyance that made the remote server very difficult to use.

Version 5 isn't a major upgrade; the most notable new features include support for XP, the ability to access systems with multiple monitors, and some security enhancements. Numerous other additions are mostly esoteric ones ("Now supports authenticating and installing group policies in a Active Directory Domain environment. Now supports being installed and operated in a terminal server environment.") that won't excite many users.

Graphical glitches aside, the program works well enough, but I can't recommend it above its myriad competitors—including GoToMyPC, Virtual Network Computing, pcAnywhere, and LapLink—unless your coworkers already use Timbuktu or there's a similarly compelling reason.

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

by Chris Pirillo

RIP, Internet Explorer

Choice? Hardly. Netscape Navigator deserves to die, even though most people would argue it has been dead for years. The only viable Web browser (as far as the Windows platform is concerned) has been Internet Explorer since version 3.0 beta 1. And if you have been using "the alternative" only because it wasn't from Microsoft, your point of view is flawed. Software should be judged by its features, which is why I believe Mozilla is set to stomp the competition.

But don't judge this browser by earlier revisions you may have tried. Install Mozilla 1.0 and you won't regret it (get the precompiled binary for your OS at www.mozilla.org). You may not be ready to dump your default yet, but after hearing about the features of this mature open-source client, you won't feel guilty about ignoring Internet Explorer. (I never thought I'd say that.)

This thing rocks. Out of the virtual box it gives you a set of managers for cookies, forms, images, passwords, and downloads. Each built-in tool will out-power the Internet Explorer equivalent every time (if Microsoft even lets you manage the option in the first place). Mozilla supports W3C standards, has a DOM inspector, and PNG transparency. Some of these features may not mean much to Joe and Judy Consumer, but for Web developers and true geeks, it's beyond awesome.

Right-click on a page and pull up its properties; it will give you everything you ever wanted to know about that particular document: encoding and content types, last modified date, meta tags, embedded forms and their actions, a list of the page's links, each image with its dimensions, and more. Open an image directly in the browser and it'll give you its dimensions in the title bar.

The burning question is: How do Web sites look in Mozilla?

Great for the most part, but you may need to rely on another browser at times. If you are still holding onto Netscape Navigator 4.x, let go. You are living in the past (it wasn't even that great a browser in its day). Understand, too, that any new version of Netscape will be built on the Mozilla code, which explains why Netscape 7.0 looks and works a lot like Mozilla 1.0.

The difference then? Mozilla doesn't bundle adware. Netscape, however, wants to give you everything under the sun to "enhance" (read: hinder) your computing experience. My personal and professional suggestion: Stick with the real deal.

The client itself is comprised of XUL components (pronounced zool; short for XML User Interface Language), which means the controls aren't hard-coded into the application's interface. In other words, you can make this browser look and work how you want it to; it is fully skinnable. You can download new themes from mozdev.org or make your own and share them with the rest of the world. Tired of pop-up windows? Use Mozilla's JavaScript manager. In a click you can turn off the launching of unrequested windows but still retain other JavaScript functionality!

The burning question is: How do Web sites look in Mozilla?

And I haven't mentioned tabbed browsing yet. This allows you to open links in a new tab within the same window. Think of it as a taskbar for your browser. It will increase "surfing productivity" by 110%. I bet your boss will love that.

And if you're tired of dealing with Outlook Express, I'm sure you'll find the bundled email and news application more than adequate. Mozilla's IRC client isn't as strong as others I've used, but it's usable. And if you need a WYSIWYG HTML editor, the Composer will help get the job done.

This is more than just a browser; it's a killer app. Its code is cross-platform, and it runs relatively well on older machines. It's not perfect, but it's no more buggy than any of Microsoft's final releases. It's no snail, but the team is working on plenty of performance boosts for v1.1. Don't let that stop you from using it today, though.

Oh yeah, the best part is its price: FREE. Microsoft is in trouble. Big trouble. ■

You can dialogue with Chris at chris@cpumag.com.

In addition to distributing Lockergnome.com and hosting "Call for Help" on TechTV (callforhelp.tv), Chris is a MWM seeking long-term, meaningful relationships with CPU *magazine readers. Nonsmokers preferred. Dogs OK, cats questionable. Preference given to those who can type over 100 WPM. All applicants must have at least three references to be considered.*

by Pete Loshin

22 Short Reviews

Pete Loshin, former technical editor of software reviews for BYTE Magazine *(print version), writes about technology and runs the Internet-Standard.com Web site, which provides plain-language explanations about RFCs, Internet standards, and other IETF documents.*

Twenty-two reviews of free software I've used and have opinions about. Half now, half next month. Many are cross-platform (marked with *), so you can try them out on your chosen OS. Apps included in the GNOME Office (www.gnome.org/gnome-office) meta-project are marked with ## to signify they use the GNOME component architecture.

1. AbiWord* ## (www.abisource.com) is my Goldilocks word processor: Not too much, not too little, it's just enough for me. A serviceable word processor on its own, AbiWord opens and edits MS Word files and saves them in any of 20 standard (and nonstandard) formats. Supporting dozens of languages and variants, from Afrikaans to Welsh, AbiWord offers WP for all without code bloat or RAM hogging.

2. Before AbiWord, *NIX users extracted text from DOC files with Antiword* (www.winfield.demon.nl). Amazing how a monstrous Word file may yield only a few paragraphs. You can pipe output to screen, a file, or other programs for further processing. Runs on OS X, Windows, DOS, VMS, RISC OS, BeOS, OS/2, Amiga, even NetWare.

3. StarOffice* (www.sun.com) isn't free, isn't open source, but it's a big, slow, and bloated office suite alternative to MS Office. To be fair, v5.2 was big, etc.; I haven't tried the no-longer-free download v6.0 or the free version OpenOffice* (www.openoffice.org) that differs from StarOffice mostly in its lack of third-party code. With plans for integration into the GNOME Office project, keep an eye on OpenOffice.

Text editors emacs* and vi* spawn religious flame wars on almost the same scale as Linux vs. Windows. Both are excellent for coding, Web content development, or any writing. Both load huge files fast, run on *many* platforms, and support serious and portable custom configuration.

4. With its Lisp interpreter (you can customize anything) and countless commands and modes for every need and function, Emacs (www.gnu.org/software/emacs/emacs.html) is more a computing environment than editor, but the online help rarely helps me, so invest in a good book (O'Reilly's "Learning GNU Emacs" and "Writing GNU Emacs Extensions" are excellent).

5. VIM (www.vim.org), or "Vi Improved," replaces vi (say vee-eye), the original but non-free Unix editor. Bare but super fast, VIM is too spartan for my taste, yet old-school hackers swear by it. It beeps whenever I make a mistake (too often), and the disorienting mode changes freak me out, but it's faster and smaller than Emacs.

6. My minimal Web development skills scream for a good HTML editor like Bluefish (bluefish.openoffice.nl). Prompting for variables in HTML elements, Bluefish supplies icons, tabs, menus, and menu bars for setting up tables, frames, forms, and lists and generates HTML tags. File and project management, plus support for CSS, JavaScript, WML, PHP, and more make Bluefish a winner.

. . . keep an eye on OpenOffice.

7. If you don't have time to learn LaTeX (and you don't), then LyX (www.lyx.org) is the answer for writing books and technical articles or any long document. Use the standard document profiles, with their standard elements (chapter, subsection, quote, etc.), to organize your document. LyX exports PostScript, PDF, LaTeX, HTML, ASCII and imports ASCII, LaTeX, and even MS Word. Despite a painful installation, LyX is fun, fast, and stable. LyX Autosave autosaves my butt regularly and reliably, and you get beautiful TeX layout for math equations.

8. If 95% of Excel's core functions are enough, Gnumeric## (www.gnome.org/projects/gnumeric) could be all you need. It meets my meager spreadsheet requirements and even those heavy-duty spreadsheeters in finance and accounting should be happy with it.

9, 10, and 11. Three browsers, one keeper: Netscape Navigator* (netscape.com) has more crashes than a demolition derby. Mozilla* (mozilla.org) is open but s-l-o-w. Despite Mozilla roots, Galeon## (galeon.sourceforge.net) does everything the others do and more, but better and faster. Two favorite features: tabs to open many pages in a single window and a bookmark toolbar for entering search terms and going directly to the results.

The score so far: I rely on AbiWord, Antiword, Emacs, Bluefish, LyX, Gnumeric, and Galeon. I could easily spend well over $1,000 for equivalent commercial software and be far less satisfied. Tune in next month for the next 11. ■

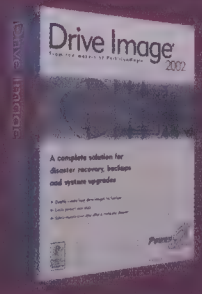
Get saucy with Pete at opensauce@cpumag.com.

COMPLETE DISASTER!

TOTAL RECOVERY

Just a moment ago things were going great. Your figures finally added up, that critical report was done and your MP3s were downloaded. That was then. Now you're looking at a blue screen on a dead machine.

But if you had Drive Image™ 2002 you could sit back and relax knowing your entire system – including exact copies of irreplaceable Word™ documents, financials, E-mails, photographs, multimedia, your operating system, programs and preferences – was safely stored, and recovery is just a matter of reload and go!



With an easy-to-use Windows® interface, Drive Image 2002 allows you to quickly make a complete copy of your entire system onto a Zip®, Jaz®, CD-R/W, network drive, disk partition or any other suitable storage device. So, when disaster strikes, all your valuable data is ready and waiting for you to put it right back where you left it.

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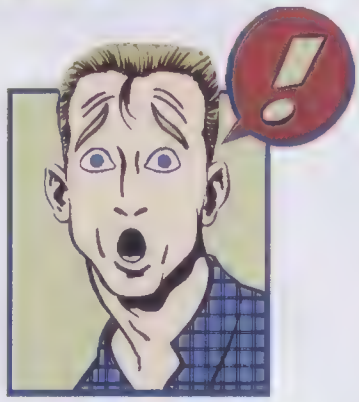
Yeah, they *actually* said this . . .

"My cat eats cloth!"

Maybe he'll cough up a new shirt for you.



"Big brother is watching you everywhere. Even at Wal-Mart."

Especially in the Mary Kate & Ashley section. And rightfully so.

"I guess to have an intelligent conversation, we have to be more precise. Define 'snot.'"

All conversations should begin this way.

"This is the most boring chat ever."

You can *shut off your computer, you know.*

The **Prodigal** Puppet

Last time we saw the Pets.com Sock Puppet, he was lying in his own filth and left for dead in the dot-com wasteland of a 2001 E*TRADE Super Bowl commercial. The demise of the Pets.com mascot was a fall from grace so complete and swift in its devastation that even Robert Downey Jr. could laugh at the poor puppet without feeling a twinge of irony. But, like Downey Jr., the Sock Puppet has been given another chance. Automotive credit marketing company 1-800-BAR NONE (www.barnone.com) bought the rights to the Sock Puppet, who will now be shilling car loans to people whose credit rating is worse than Enron's.

I'm glad to see the Sock Puppet making a comeback. The road from shame to redemption is often a long and difficult one for many celebrities, often involving stints in phone commercials, Hollywood Squares, and Celebrity Boxing matches. The BAR NONE gig is only a notch or so above those celebrity purgatories, but I'm hoping it leads to better things, such as an appearance on Letterman, or at least Craig Kilborn's show. Hey, everybody deserves a second chance. ▲

Infinite Loop

You Never Write

Ever get the feeling that corporate America is ignoring you? Well, that just might be the case. As part of its annual Web-Index study, the public relations firm Rainier (www.rainierco.com) tried to request basic investor information via email from Fortune 100 companies. Ranier was able to contact only 87 companies online. After four weeks, 19 of those companies had yet to reply. Those numbers were slightly better than in Britain, where 23 out of 87 top British companies didn't return an email within the same four-week period.

Source: Third Annual Rainier Web-Index Study

MEATHEAD

Once upon a time, men always wore hats in public. You've seen the pictures from the '40s and '50s of fans at baseball games, rather lines upon rows of men wearing white short-sleeved shirts, dark ties, and hats on a baseball game! If we beheld such a sight today, we'd regard those hat-wearing freaks with suspicion and contempt.

Today people rarely wear hats in public or private, unless the hat happens to be of the "hard" variety and the person wearing it is a construction worker or a member of the Village People. Today we wear caps or no hat at all. But our no-hat culture may be about to change, thanks to a new fashion phenomenon: the meat hat.

The Hats of Meat Web site (www.hatsofmeat.com) showcases the latest trends in cutting-edge wear in the site's photo gallery. The Bass-Ball cap will be a hit among the Generation X and Y crowds with its funk stink visor and ground beef cap. Canada isn't known for being a fashion mecca, but the Canadian-style hat, a bonnet of back bacon and sausage links, will keep your ears warm during the winter. The Cow Boy hat shows its styling cues from the classic headwear of the 19th century and is ready for the finest cuts of the cow herd that you can have trotted across the prairie for a century and a half. Those seeking more leather might happen upon the Bridal Yarmulke. Of course, the photo gallery wouldn't be complete without the meatiest of all headgear, the Fedgar hat.

The Hats of Meat Web site includes a "history" of meat hats through the ages, including Montezuma's "Sombrero de la Pollo" (Hat of Chicken) and Abraham Lincoln's vaudeville-smuggler hat. The FAQ section has helpful advice for taking care of your meat hat. For example, it is recommended that you keep your hat in the refrigerator when you're not wearing it and that you lightly baste an older meat hat with a marinade to keep it from smelling too gamy. By the way, you should not eat your meat hat, unless it's made of beef or jerky. Then it's OK. ▲

Face Off

Celebrities brand themselves as well as their music or movies, which is why we have Britney dolls and Austin Powers action figures. But sooner or later, those celebrities are going to take their final bows on this mortal stage, and wouldn't you like something to remember them by? Of course you would, so go to the City Morgue Gift Shop (www.citymorguegiftshop.com/index.shtml) to find the latest in dead celebrity gear.

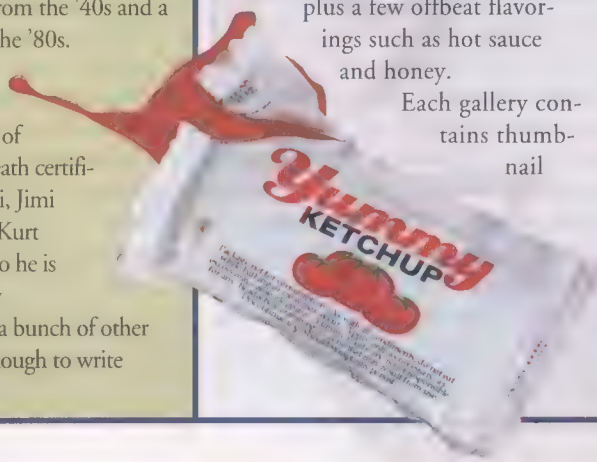
The featured item at the Gift Shop is a collection of life masks (masks made from plaster casts of a celebrity's face), including old-school horror stars such as Bela Lugosi, Boris Karloff, and Vincent Price. There are two Vincent Price masks available: one from the '40s and a decidedly scarier one from the '80s.

The life mask library is fairly limited, but the Gift Shop has an ample selection of reproductions of celebrity death certificates, including John Belushi, Jimi Hendrix, Marilyn Monroe, Kurt Cobain, and Lorne Green (so he is dead! Who knew?) The City Morgue Gift Shop also sells a bunch of other stuff that's not interesting enough to write about. Stop by today! ▲

The Gallery Of Goo

In last month's Fringe column, I showed you the disturbing world of the Lego Death museum. This month, I wanted to visit a museum with a little more taste, so I stopped by The Condiment Packet Museum (www.clearfour.com/condiment/cindex.html). Andy Warhol would love this site, which features condiment packets of nearly every kind. The museum is divided into several galleries, each pertaining to a particular condiment. All the favorites are here (ketchup, mustard, relish), plus a few offbeat flavorings such as hot sauce and honey.

Each gallery contains thumbnail images of individual condiment packets; just click the thumbnail to see a larger picture of the packet. As you'd expect, the Ketchup gallery has the most acquisitions, including packets of Ketchup, Catsup, Tomato Ketchup, Tomato Catsup, Fancy Ketchup, Ketchup/Catsup, Grade A Fancy Ketchup, and one packet of Blastin' Green Ketchup. The Mustard gallery is also well represented, with packets of mustard, hot mustard, Chinese style mustard, Grey Poupon Dijon Mustard, and, well, you get the idea. The Special Galleries section includes an oddball variety of condiment packets, and there's also a large Museum Info section including News, FAQs, and a guestbook. ▲



If you find a strange, interesting, or funny Web site in the course of your Internet travels that you think is worthy of Fringe, send your suggestion to fringe@cpumag.com

TIMEWASTERS

You Are Here

Domain Name Registry

Grab A Piece Of The Web For Yourself

A domain name on the Web is more unique and identifying than your personal name. Although there's no rule against how many people can be named Bob Johnson or Susan Miller, there can be only one www.bobjohnson.pro or www.susanmiller.name. The role of assigning domain names falls to Web–based domain name registars.

ICANN Do It

To sell domain name rights, registrars must receive Accredited Registrar status with ICANN. This technical coordinating organization has the responsibility of overseeing the assignment of Internet domain names, IP address numbers, and protocol parameter and port numbers.

All domain names are organized in the Internet DNS (Domain Name System) directory. When a domain name is registered, the DNS directory keeps track of the computer on the Internet that is hosting that URL for the duration of the registration period.

Not all domain name registrars handle registrations in each of the top-level domains. When a registrar applies for Accredited Registrar status, it must pay a separate fee for each global TLD (such as .com, net. and .org) it wants to offer. ICANN-accredited registrars may also issue names with different country code TLDs, but ICANN does not specifically accredit registrars to provide registration services for ccTLDs.

VeriSign & Register.com

The process of registering a domain name is not complicated. The steps you need to take at two of the top sites—VeriSign (www.verisign.com) and Register .com (www.register.com)—are similar.

According to SnapNames, a company that analyzes domain name registrars, VeriSign is the top-ranked domain name registrar. (VeriSign acquired Network Solutions, the then-leading registrar, in March 2000 in a $21 billion deal.) VeriSign's registry service is just a portion of the many services it offers customers looking for an online presence or wanting to enhance their ecommerce.

At VeriSign, you'll start by using the free domain name lookup tool (www .netsol.com) to see if the name you want is available. VeriSign manages more than 12 million active domain names, but your search will extend beyond that database. Through its Global Registry Services, VeriSign maintains a directory of more than 27 million URLs in the .com, .net, and .org gTLDs and handles billions of domain name lookups every day.

If the name you want is available, you can begin the buying process. The domain name will cost $35 per year. If you sign up for multiple years, the annual cost will be less. (Prices are slightly higher for a domain name in the .tv gTLD.)

New Top-Level Domains

In November 2000, the governing board for ICANN chose seven new top-level domains, the first TLDs to be introduced to the Internet since 1988 (other than country code TLDs). These new global TLDs fall into two categories:

Unsponsored:
.biz for businesses
.info for unrestricted use
.name for individual users
.pro for professional users, such as doctors and lawyers

Sponsored:
.aero for the air transportation industry
.coop for cooperatives
.museum for museums

Before you finalize your domain name purchase, you can get additional VeriSign services. Want to forward your site visitors to an existing Web site? That'll be $12 a year. To get your site listed in top search engines, you'll have to fork over $39 a year. VeriSign's personalized email service runs $49 annually, but that includes the price of registering your domain name. Other services you can consider include transferring domain names from one owner to another and one-page or five-page Web site design and hosting. The cost of the latter includes the price of acquiring the domain name.

Register.com works similarly to VeriSign. You'll find a free domain name lookup tool on the home page. If your search is successful, Register.com will include other possible domain names similar to the one you searched for. The price of a .org, .net, or .com domain name for a year is $35. Register.com also offers the free Domain Fast Find service, which will help you create a domain name if you're stumped for a good one at the moment.

Like VeriSign, Register.com offers a number of extra options, from bulk registration of domain names to email boxes and Web site design. Using the WebSiteNOW! Service, you can create a small site for less than $5 a month.

All the good names are gone. The only thing that may impede your domain name registration is if someone has already taken the name you want. If that's the case, one option is to back order the name using the SnapBack service on the VeriSign site. For $69, the service will create a SnapNames account for you and then monitor the status of that domain name for as long as one year. If it becomes available, SnapBack will try to register the name for you. The $69 charge for this service includes the fee for registering the domain name through VeriSign for one year. If SnapBack can't get the name for you, you can apply that fee to the cost of registering a different domain name.

VeriSign's search tool also will suggest alternative names for you if the domain name you looked up is unavailable. When we searched for www.breadbox.com, VeriSign informed us that it was already taken but helpfully offered a long list of alternatives, including www.bread-box.com and www.sandwichesbox.com.

Tucows OpenSRS

Although they welcome individual customers, both VeriSign and Register.com also target businesses of all sizes that typically need to purchase extra services in addition to a domain name. If you don't need those add-on services, you may want to hunt around for bargain registrars. There are hundreds of them.

One of the more unique registrars is Tucows. Instead of registering domain names for individuals, this site recruits companies, such as local ISPs and Web site hosts, to become registrars through its Reseller Program. Tucows resellers, found in more than 100 countries, register domain names and digital certificates using Tucows' OpenSRS platform (resellers.tucows.com/opensrs). This system lets resellers offer their customers domain name registration, renewal, and transfer services that are similar to the ones you'll find at VeriSign and Register.com. And the bulk nature of the OpenSRS program keeps costs to the end user low.

The number of total annual domain name registrations through Tucows resellers has vaulted this firm into the ranks of the top domain name registrars, along with VeriSign and Register.com. Tucows end-user customers may not even know they have registered a domain name through this company unless the reseller they went through informs them. CPU

by Rachel Derowitsch

See www.smartcomputing.com/cpumag/sep02/domainname for more.

Top Brass

We spoke with John Donoghue, senior vice president at VeriSign, about the company's approach to domain name registration.

CPU: VeriSign acquired Network Solutions about two years ago and telecommunications companies Illuminet and H.O. Systems during the past year. How has VeriSign's business changed and evolved over this time, and how do these acquisitions fit into VeriSign's overall business plans?

Donoghue: VeriSign began in 1995 as a provider of Internet security solutions. The company has grown tremendously since that time and is now the leading provider of digital trust services, enabling anyone to engage in commerce and communications. The acquisitions of Network Solutions, Illuminet, and H.O. Systems have helped build out our four core offerings: Web presence services, security services, payment services, and telecommunications services. We sell these services to large enterprises and small businesses alike.

At the end of first fiscal quarter of 2002, we had more than 4,400 active enterprise customers, 1,000 carrier customers, 70,000 payments customers, 12 million domain names under management, approximately 5 million customers in our registrar, and more than 27 million domain names in our registry.

CPU: Are there particular segments of customers you target in your lines of business? For instance, do your Web presence and Global Registry services businesses target particular groups of customers? Likewise, are there groups of customers you'd like to increase registrations among?

Donoghue: VeriSign's domain name registrar provides Web presence services to large enterprises, as well as small and medium-sized businesses. Our registrar also provides a full array of value-added services, such as Web building tools and personalized email services. Basically, we can help any customer develop and maintain their Internet presence during any stage in their business life cycle.

CPU: What changes or innovations can customers expect to see from VeriSign in the domain name registration business in the next couple of years?

Donoghue: VeriSign is unique in the Web presence services space because of what we're able to provide. Our customers come to us looking for a successful Internet presence and business, not just a name. One of our biggest successes has been in bundling our services. For instance, we can provide our customers with a domain name, help them build their Web site, secure that Web site, market their services to their unique customers, and even provide them with payment services. We've built out comprehensive services to provide our customers with one convenient place for all their Web presence needs. We've found that this is what they want. In fact, a recent study by Harvard University found that more than 83% of Fortune 1000 companies use VeriSign as the registrar for their domain names.

Our emphasis will continue to be on bundling our services and providing the value-added services that make the difference between simply getting a domain name and building a truly successful Internet business and online brand to communicate with customers.

CPU: How has the addition of the new TLD names changed your registration services? Have you seen a lot of registrations in those domains?

Donoghue: The seven new gTLDs have helped to broaden the landscape for businesses and individuals, professionals looking to develop and grow their digital identities. Several of them have seen a fair amount of growth in the short time they've been available. Most of them, however, have been live for a year or less, so it's still fairly early to see what their overall impact will have in terms of creating new opportunities for online identity. .com remains the most widely branded and recognized domain name, and we expect that to continue for the foreseeable future. ▲

Coder's Corner: XML

Lizard Wrangling With XUL

In Coder's Corner: XML, Ian Graham shows you how to program with XML. Ian is the author of numerous books pertaining to Web development, including "The HTML Sourcebook" and "The XML Specification Guide."

The recent preview release of Netscape 7 is an interesting example of XML in action. In it, XML is more than just a displayable data format. Instead, XML is a central component in the design and implementation of the browser that's used for storing configuration data, specifying bindings between core software components, and defining the layout and structure of the entire user interface. We'll look at how this radical browser design came to be and how it uses XML to define the user interface layout.

The Story Behind The Story

In January 1998, Netscape announced the open-source Mozilla Project (www.mozilla.org) with the aim of creating a completely open-source Web browser out of existing Netscape browser code. Netscape hoped this would rebuild enthusiasm for its browser and bootstrap rapid technical advancement onto a product already feeling pressure from Microsoft's more technically advanced Internet Explorer. This time period was at the height of the browser wars, and Netscape hoped the move would keep it ahead of the impending Microsoft tide.

From that perspective, it was too little, too late. Microsoft's browser market share continued to grow, while the Mozilla Project was slow to produce a newer, better browser that Netscape could release. With market share (and stock value) slipping, the writing was on the wall. In November 1998, AOL purchased Netscape. The dream appeared over.

Somewhat surprisingly, the Mozilla Project continued under AOL; surprising because there was no impending Mozilla release and no compelling use for the Mozilla products in AOL's client suite. The Mozilla development team had already decided to completely discard the original Netscape code and start from scratch, virtually guaranteeing it would be more than a year before it had anything to show for its work. In fact, it took almost four years to produce the Mozilla 1.0 browser recently released in June. The Mozilla 1.0 code is also the core of Netscape 7. Netscape 6 is based on an earlier beta version of Mozilla. So, if you're running Netscape 6 or later, you're actually running Mozilla.

Philosophically, there were important reasons for the change in direction and delays. Essentially, the Mozilla team had decided to rethink its goals based on the philosophies of using only open standards, such as XML, DOM (Document Object Model), CSS, and JavaScript, and designing for portability so components built for the project would be portable to any OS—including Unix, Linux, Mac OS, Windows 98/2000/XP, OSes for wireless devices, and others—and work the same in all cases.

The Mozilla team also had certain design goals, including developing a foundation of core modular software components that could be wired up to build a variety of Internet apps, with a browser being just one example. The team also had a goal of using open standard technologies—namely XML, CSS, and JavaScript—to wire up the modular components and make the actual apps. For example, the Mozilla browser suite is built using numerous basic components that are wired up to produce the browser. This "wired up" process uses XML and CSS to define the user interface, plus XML and JavaScript to define the wiring design and configuration data, such as how the parts are assembled.

In addition, the underlying components can help build various Internet-enabled tools, such as mail clients, IRC clients, editors, and more, all by using

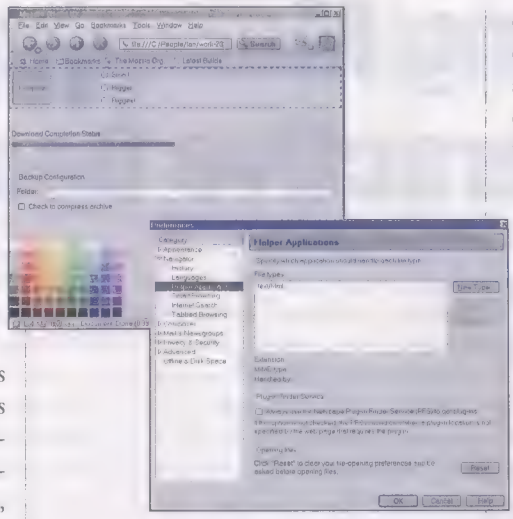
XML, CSS, and JavaScript to wire up these core software parts. Thus, the Mozilla Project is producing more than a browser; it is really creating a foundation toolkit for building a family of platform-independent Internet clients and services.

XUL: XML User Interface Language

XUL, pronounced "zool," is one wired-up tool the Mozilla project created. XUL is Mozilla's platform-independent language for defining the component parts and layout of a user interface. XUL contains elements for declaring interface components, such as text input boxes and checkboxes, toolbars, menus, tabbed dialogs, color pickers, etc., plus markup-content models that specify how these are laid out together when displayed. CSS can define or modify the styling details for XUL elements. In general, Mozilla-based apps assume default formatting styles for XUL, similar to an HTML renderer assuming default formatting rules for HTML elements.

The following XUL example illustrates user interface elements and how a XUL document is constructed:

```
<?xml-stylesheet href="chrome://
global/skin/" type="text/css"?>
<window
 xmlns="http://www.mozilla.org/key
 master/gatekeeper/there.is.only.xul">
 <hbox style="border: 2px outset">
  <button label="Poopsie"/>
   <button label="Phlegm!" disabled=
   "true"/>
  <radiogroup>
     <radio label="Small" />
     <radio label="Bigger" />
     <radio label="Biggest" />
  </radiogroup>
 </hbox>
 <spacer flex="1" />
 <description>Download Completion
 Status:</description>
 <progressmeter value="50%" />
 <spacer flex="1" />
 <groupbox>
   <caption>
    <description>Backup Configuration
    </description>
   </caption>
   <hbox>
    <label value="Folder:"/>
     <textbox flex="1"/>
   </hbox>
   <checkbox label="Check to compress
   archive"/>
  </groupbox>
  <spacer flex="1" />
  <colorpicker />
</window>
```



The far window shows how Mozilla 1.0 renders an example XUL file. The near window shows a typical Mozilla preferences window, with the components and layout in it, and that in the main browser window, being defined using XUL.

The (root) window element defines a new window into which the XUL layout elements are placed; it essentially defines a container for the content. The root must declare the XUL namespace using the following: xmlns="http://www.mozilla.org/keymaster/gatekeeper/there.is.only.xul"

The window's first item is a set of buttons (which button elements indicate) and radio buttons (radio elements inside a radio-group element). These go inside an hbox element, a XUL layout element that calls for horizontal layout (XUL's default is vertical layout). If you downloaded the example, you'd see the components side by side and surrounded by a dashed blue line, which is due to the CSS style rule specified for the hbox element (style="border: 2px outset"). All XUL elements support a style attribute for setting CSS style rules.

The hbox is followed by a spacer element, which adds space between XUL components. By default, spacers can expand or shrink as the window is resized. The flex attribute defines the relative sizes of these elements. So, an element with flex="2" is twice the width (or height) as flex="1".

The next element is a progressmeter. It defines a download status meter similar to those you see when downloading a file. This example progressmeter has a value of 50% (half-complete). In a real app, a JavaScript component would dynamically adjust this value to indicate the percentage of the task that's complete.

The third element is a groupbox. It defines a captioned grouped box ("Backup Configuration"). This component is displayed so it's obvious that the elements' contents are grouped together. This group contains a textbox element for text input. It has an associated label ("Folder:"). Note how the label and textbox are inside an hbox so that they're laid out horizontally and not vertically. The last component in the grouped box is a labeled checkbox.

The final component (after another spacer) is a colorpicker element. This element corresponds to a colorpicker widget, which lets the user select a particular color. Note also that the example begins with the following XML style sheet reference:

<?xml-stylesheet href="chrome://global/skin/" type="text/css"?>

This loads a default style sheet defining various formatting properties for XUL elements. Note the use of a special chrome: URL for this; the Mozilla architecture defines the chrome: URL's syntax and uses such URLs to reference XML, JavaScript, and CSS files that collectively define how user interface components are laid out and work together. By typing **chrome://global/skin/** into Mozilla (or Netscape) and retrieving the resource, you'll see the CSS code defining these default properties.

Make XUL Your Tool

These are only a few ideas behind XUL. Mozilla's Web site has more information.

(For full examples, see www.smartcomputing.com/cpumag/sep02/xmlexamples and www.utoronto.ca/ian/articles/sep02) CPU

by Ian Graham

by Lisa Lopuck

Using Metaphors In Interactive Design

Lisa Lopuck, www.lopuck.com, is a Web creative consultant helping companies define and plan their Web creative strategy, information flow, and visual look and feel. She is also the author of numerous best-selling books on Web design, including "Web Design for Dummies," and is a sought-after speaker at Web conferences and universities around the world.

In the early days of interactive media (and I mean 1987, when the first HyperCard stacks were being designed), using metaphors like books and file cabinets to aid in usability was all the rage for multimedia applications. Following on the heels of Apple's 1984 visual desktop metaphor, it made sense. After all, interactive media was new, and people were not accustomed to navigating through rich media.

Users Catch On

In the years that followed, however, metaphors became less and less useful because people started to "get it." Instead of making the whole screen look like a book so that people "got" that there were pages to flip through, designers could abstract the metaphor down to simple left and right arrows to turn multiple pages. This way, more of the screen could be devoted to the actual content, and more importantly for the evolving Web technology, the pages could have less graphics to download.

Most people are now savvy enough to understand the concept of navigating through a multitiered environment using simple visual cues like underlined links, buttons, and the more metaphorical tabs. Today, over-using a metaphor is sort of like saying "leave your message after the beep." Who doesn't know how to do that?

Today, over-using a metaphor is sort of like saying "leave your message after the beep." Who doesn't know how to do that?

The Danger Zone

Still, I see a lot of clients and designers who think it would be cool to carry a visual theme through a Web site to help differentiate themselves. When taken too literally, metaphors get you into the danger zone. One client of mine tried using a 3D office illustration as an interface for an educational CD-ROM. Objects in the office led to sections like "Business" and "Community." Let's see, does the unlabeled phone on the desk lead to the Community or the Resources section? You see where I'm going.

Here's my short list of big problems with metaphors for any interactive media:

a) Metaphors such as rooms and objects can take up the entire screen just to illustrate, leaving little or no room for the actual site content.

b) Metaphors often require heavy use of imagery and illustration, which can create a hefty download.

c) Metaphors break down after the first page. Even if you successfully create a metaphor that accommodates all your links, what happens when you click? Your content has to go somewhere on the page.

Abstraction Is The Key

Metaphors can be helpful as long as they remain under adult supervision. Metaphors such as the popular tabbed-shaped buttons actually work because they don't take up too much space. Aside from tabs, not many real-life objects lend themselves well to interface design elements. If you have an online bird store, for example, don't use a birdcage for your interface—placing buttons on the vertical cage rods complete with clanking rollover sound effects. The better tactic is to *imply* the metaphor with subtle background tile imagery or navigation buttons with graphical accents. By abstracting metaphorical themes, you create a site that is practical from a usability and content accommodation standpoint and is visually differentiated. ■

You can contact Lisa at lopuck@cpumag.com and see her work at www.lopuck.com.

by Rob "Cmdr Taco" Malda

encryptd.txt

Rob "CmdrTaco" Malda is the creator and director of the popular News for Nerds Web site Slashdot.org. He spends his time fiddling with electronic gizmos, wandering the 'Net, watching anime, and trying to think of clever lies to put in his bio so that he seems cooler than he actually is.

Encryption is a strange little beast. Its history has been an ongoing and escalating race between the code builders and the code breakers. These codes were used for anything, but we mostly remember their use in wars. We think about World War II and the Enigma codes used to help win that war.

Back in those days, encryption had a steep barrier. Customized machines were necessary for Enigma. And in the following years, codes required computers to make and to break. With computers costing as much as castles, and being nearly as large, it just wasn't much of an issue. The desktop computer revolution changed all that. Now we have machines capable of encrypting and decrypting massive amounts of data. But we aren't using encryption in the name of war. We're using it to send our emails, from the trivial to the critical, around the world.

But the people in the content industry have other things in mind. They want us to buy their films. They want us to buy their books. They want us to buy their albums. But there is a catch: The digital revolution allows users to make infinite copies, and each copy is just as clear as the original. This scares the people in the content industry out of their heads.

The content industry has learned its lesson, and it will not make the same mistake twice.

And I guess it's reasonable that they are scared. Their industry is changing. But Napster changed everything for just a few reasons. First is the fact that CDs store audio in an unencrypted format. Twenty-five years ago, nobody could have known that the technology to compress and transmit audio so easily was coming.

The content industry has learned its lesson, and it will not make the same mistake twice. Film is the next victim, but this time around, the industry has the DMCA (Digital Millennium Copyright Act) to back it up. This makes it illegal to traffic copyright circumvention technologies, and because the DVD format has a rudimentary encryption system, the content industry can try to sue anyone who tries to rip DVDs.

This is just the first half of the problem. The second half is largely due to TiVo. The TV industry is scared of TiVo. The time-shifting abilities of the machine actually cause most people I know with the device to watch more television. But they often fast forward through the ads that the media companies need to generate revenue.

The thing is that TiVo is still fairly low quality, especially the analog TiVo, which degrades picture quality substantially. As TVs get bigger, viewers' needs for quality increase. Which is where HDTV comes in. The networks have been stalling for years to get HDTV online. The FCC is requiring that they do it, but they're taking their sweet time, and now we know why.

The content industry wants to make sure that HDTV transmissions are encrypted. This allows them to use the DMCA to prosecute anyone who tries to pirate their signals because they will have to decrypt the content at some point. Also, the TiVos and ReplayTVs of the world will be hard-pressed to do their job on an encrypted data stream, unless they work with the media companies.

This is all guaranteed because future video components will use DIY connectors, and eventually the content will be encrypted from the time it is recorded to the time your TV decrypts the video stream and projects it into your living room. And if you crack into that stream along the way to invent things like VCRs, TiVo, or Napster, you will face the might of the media world and the controversial DMCA.

These companies managed to put a man in jail for decrypting DVDs. That's a far cry from the lawsuits against Betamax that made VCRs legal and made concepts like Fair Use and Time Shifting part of what we consider our rights as consumers.

So really it's still a war. This time it's not about dictators and control of land, but encryption is still a critical weapon being used to control our freedoms. Not just to watch TV or listen to music when and where we choose, but also to lock people up who try to do it. At least this time around there are no deaths, but I'm still having a hard time feeling good about it. ■

Send your rot1- encoded comments to malda@cpumag.com

by Joan Wood

Online Traffic School

Just in case you took last month's Spotlight section to heart (or foot) and used all those nifty in-car gadgets to acquire a first-class speeding ticket, here is a high-tech follow up: Online Traffic School.

Eligibility

Follow the instructions on your citation for contacting the court to determine your eligibility and the specific procedure for attending traffic school. The type of offense and length of time since you last elected traffic school along with the particular court's position will determine your eligibility. Most states allow traffic school but many have not yet certified online courses. Alaska, Arizona, California, Colorado, Florida, Missouri, Nevada, New Mexico, Ohio, Oregon, Texas, Utah, Virginia, West Virginia, and Wyoming are among the states with courts that have permitted some form of online traffic school.

Usually you must pay your fine and a traffic school-processing fee to the court before signing up for school. Many courts allow you to pay over the phone or online. If the court has not yet processed your citation, you must still follow the instructions for appearing in court to avoid the possibility of a more serious charge of failure to appear (can include fines, jail time, and a bench warrant being issued), so read the fine print. Once the court has agreed to allow you to take an online traffic school course, they will give you a completion date. Make sure you allow plenty of time to complete the course, pass the tests, and mail the completion certificate. Some courts require that you take the test in person, providing photo ID.

Trafficinteractive.com features an interactive gaming approach . . . but think Jeopardy, not Doom III.

Selecting A School

An "online traffic school" Google search will give you several choices. Make sure that the court with jurisdiction over your violation has approved the company and course you are selecting. If it has not, you may still be able to take it, but you must get permission from the court clerk or judge. Most sites have a pull-down menu database of courts from which they have already received approval. Pricing ($17 to $50) varies by company and by state. Many schools will refund your money if you don't pass or allow you to keep taking the test until you do. Some companies will deliver your completion certificate directly to the court; others will only send it to you. If your court requires that your signature appear on the final certificate, you will need to receive it personally anyway.

Know your specific circumstances to avoid last minute panic. Read and understand the school's "Terms & Conditions" user agreement. You still have to make any mandated court appearances, your state's vehicle code may have different information than what is presented online, etc. While schools present the same basic material, they each have a different pitch. Interactive Traffic School (www.trafficinteractive.com) features an interactive gaming approach to the process, but think Jeopardy, not Doom III. The On-Line Traffic School, Inc. (www.onlinetraffic.com) may be "The first and largest on-line traffic school," but it is only available for tickets received in California.

Prevention

Legal self-help sites such as NOLO.com (browse the Cars & Tickets Law Center listing) can provide general background information on traffic stops, as well as specific advice for avoiding tickets or fighting them in court. Many sites contain information on radar detection and local speed traps (www.speedtrap.org). Taking a defensive driving course, even online, can also lower your insurance rates, so check with your insurer.

Aggressive Driving Laws

Across the country, states are toughening laws regarding reckless/aggressive driving. Many types of commonly encountered driving behavior can now be classified as aggressive and prosecuted harshly. Drivers cited for three or more moving violations at the same time (such as speeding while making sudden lane changes and passing improperly) can be charged under reckless driving laws, with much stiffer penalties. So give it a rest on the road and play more Gran Turismo 3. ■

Think you're fast & furious? Email me at joan@cpumag.com.

Starting as gopher for the Emmy-winning team that pioneered live in-car TV cameras for the Indy 500, Joan became an independent video/sound engineer, technical director, and producer. Playing with Reality Engines and motion platforms led to co-founding Xatrix Entertainment, where she produced the two Cyberia games. Before 3D acceleration was trendy, she formed Mango Grits to develop hardware-only game Barrage for Activision. Since cashing out from SharkyExtreme.com, where she was co-founder and managing editor, Joan has retired.

CHECK IN FROM THE COMFORT OF YOUR VERY OWN SCHEDULE.

Print your boarding pass at nwa.com Check-In℠ from almost anywhere.
As the first major network carrier to offer Internet check-in, we've made flying easier and more convenient than ever. Visit us for details at www.nwa.com/checkin.

NORTHWEST AIRLINES

©2007 Northwest Airlines Inc.

by Chad Denton

Road Warrior

Voices In Your Head, XScale Disappointments, RIM's Future, Tablet PCs & More From The Mobile Front

Silicon Fillings

Ever hear the urban legend about the guy who could pick up television or radio broadcasts with a filling in his tooth? British developers at the Royal College of Art in London believe they've actually developed the stuff of legend. James Auger and Jimmy Loizeau co-developed a tiny device that, once embedded in a tooth through routine dental surgery, can relay sounds to the inner ear using bone resonance. The idea is to relay data through an intermediary device, such as a cell phone, to the tooth receiver. The receiver then vibrates, sending the sound through your jawbone directly to the inner ear so no one can eavesdrop on your conversation. Imagine listening to the latest financial news at the movies without disturbing anyone or checking the score of the big game while sitting in church. The device could even give rise to a new generation of Cyrano de Bergeracs. From the implant to the sending of the sound up the jawbone, the whole process just sounds painful to us. We'll admit, though, it beats Maxwell Smart's shoe phone.

Introducing New Palm OS Hardware

Several companies introduced new PDAs recently at TECHXNY, including Sony (www.sonystyle.com) announcing its new CLIE T665C ($399.99). No one seems to have gotten more multimedia performance from Palm OS 4.1 than Sony. The T665C is similar to Sony's older T615C. Like that model, the T665C runs Palm OS 4.1, has a color display, and includes 16MB of RAM. The T665C, however, is also capable of MP3 playback and includes a 66MHz Dragonball processor, twice as fast as the 33MHz Dragonball in the T615C.

Smartphones is another area that is pushing the Palm OS onto new platforms. For those who like to mix voice with data, Kyocera (www.kyocera-wireless.com) was showing off its 7135 smartphone at TECHXNY. Kyocera's 7135 combines Palm OS 4.1 with analog cellular support, CDMA PCS (1,900MHz), and CMDA Cellular (800MHz). The phone's clamshell design features a high-resolution color display that's supposedly viewable under various lighting conditions. Unlike Handspring's Treo devices, the 7135 has a keypad rather than a keyboard, suggesting the device is designed to be a phone first and a PDA second (a suggestion that the clamshell design reinforces). Other features include support for third-generation CDMA2000 1X networks, GPS, and MP3 playback. The 7135 was to be available sometime in late summer or early fall and will most likely cost between $500 and $600.

XScale Devices Disappoint

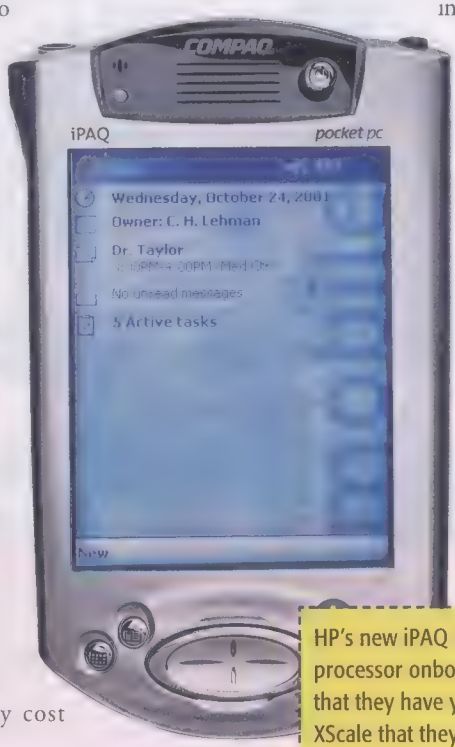
Some of the more interesting devices that debuted at TECHXNY were Pocket PCs running Intel's (www.intel.com) new XScale chip. Both Toshiba's e740 and HP's iPAQ H3900 series include a 400MHz Intel PXA250 XScale processor. The new CPU offers a significant bump in clock speed over the 206MHz StrongARM chips in previous Pocket PC devices.

Toshiba's (www.toshiba.com) Pocket PC e740 ($599) includes built-in 802.11b support, as well as a Type II CompactFlash slot and a SD/MMC card slot. An optional battery provides additional battery life (especially important if you're going to listen to a lot of music), and an optional expansion pack provides a video port for an external monitor and USB port.

The new iPAQ, the first under the HP (www.hp.com) name, also has a 400MHz PXA250 XScale processor. A more expensive H3970 model ($749) has integrated Bluetooth, while the H3950 forgoes Bluetooth and costs $100 less. It's nice to see Bluetooth making its way into products, but $100 seems steep.

The new Pocket PCs have interesting wireless features, but many users aren't impressed yet with the XScale chip. The ARM-based XScale processor uses the ARM V5 instruction set, while Pocket PC software is written for the ARM V4 instruction set. The result is a disappointing performance that Intel claims will persist until developers write software specifically for ARM V5. Microsoft doesn't seem ready to write a version of Pocket PC specifically for ARM V5, saying it would have to maintain Pocket PC software versions for ARM V4 and ARM V5. Because ARM V5 is backward compatible, software written for ARM V4 will run on PDAs with ARM V5, but it will run more slowly than ARM V5 code.

It'll probably be some time before software can take full advantage of Xscale hardware. Until then, think twice before shelling out cash for a new Pocket PC.



HP's new iPAQ Pocket PCs include the new Intel XScale processor onboard. Some consumers have complained that they have yet to see the kind of performance from XScale that they had expected.

RIM Maps Out Future

Research In Motion (www.blackberry.com) has made plans for its future BlackBerry communication devices public. RIM recently released its BlackBerry 5810, which added support for voice, as well as corporate email. The 5810 also includes support for 1,900MHz GSM networks, which are popular in North America but not in other parts of the world. RIM plans to release a "world band" version of the 5810 that will support 900MHz GSM networks found in Europe and Asia, in addition to 1,900MHz GSM networks. The new model will also feature a removable rechargeable battery, so globe-trotters can pack several rechargeable batteries and replace them as needed.

RIM also plans to support additional networks, including Motorola's iDEN network and CDMA 1xRTT networks. Support will be built into the BlackBerry Enterprise Server software, as well as new handhelds. This should let companies take advantage of different wireless networks without needing to change or upgrade software.

RIM has also mentioned numerous other features for the near future, including tri-band support (1,900MHz, 1,800MHz, and 900MHz networks), color displays, voicemail access, and new wireless synchronization options.

RIM's BlackBerry 5810 includes support for GSM 1,900MHz wireless networks used in North America. The company plans to add support for GSM 900MHz networks found in Europe and Asia in future versions.

Will Flat Be Big?

Although the actual Tablet PC that HP is expected to release soon will most likely look very different, this prototype gives you a good idea of the kind of form factor Tablet PCs are likely to assume.

Besides HP, who recalls those handheld devices that were halfway between a notebook and a PDA? Like a PDA, those devices lacked a hard drive and relied on Windows CE. However, they included a keyboard like a notebook. As notebook prices fell, handheld computers started becoming more and more scarce. Well, manufacturers and developers have gone back to the drawing board to create a new class of portable computer.

Known as Tablet PCs, this new generation of devices won't ask users to make so many concessions. For example, it was impossible to run desktop applications on handheld PCs because the handhelds ran a stripped-down version of Windows, lacked a hard drive, and relied on less powerful processors. Microsoft expects Tablet PCs to include notebook processors and a hard drive, and the devices will run a special version of Windows XP dubbed as Windows XP Tablet PC Edition (www.microsoft.com/windowsxp/tabletpc), which is to be available to developers in November and include special software for the device's touch screen display. Aside from the touch screen extras, there won't be any difference between Windows XP and the XP Tablet PC Edition, meaning Tablet PCs will be able to run any Windows application.

Manufacturers expected to produce Tablet PCs include such newcomers as Motion Computing and established companies, such as Acer, Fujitsu, NEC, and Toshiba. Some of the designs are simple slates with wireless keyboards. Other models have a bit more style. Acer's TravelMate 100 looks like a typical ultraportable notebook, except the display rotates to transform the device into a Tablet PC.

Microsoft is touting the touch screen display as a major benefit. Users can markup documents and emails or take notes in their own handwriting, with handwriting-recognition software transforming handwritten words into standard computer text. All Tablet PCs, however, will include some sort of keyboard to offer a more traditional method for entering text.

Microsoft expects Tablet PCs to appeal mostly to business users it dubs "corridor warriors," or individuals who move from meeting to meeting and need an easy-to-use tool to access information from a corporate network and take quick notes. Tablet PCs are expected to cost somewhere in the $2,000 range, making them a viable alternative to notebooks, provided Tablet PCs can do everything an ultraportable notebook can do and more.

Although Microsoft sees the Tablet PC as a business tool, it's touting its Windows CE for Smart Displays as a new consumer technology. Windows CE for Smart Displays, also known by the code name Mira, will enable a new kind of computer system that includes a detachable monitor. Using a wireless connection to a desktop, users can roam the home to view recipes in the kitchen, read email on the couch, and, dare we say, subscribe to computer magazines from the bathroom.

At Your Leisure

Compiled by Samit G. Choudhuri & Chris Trumble

Plug In, Sit Back & Fire Away

The entertainment world, at least where it pertains to technology, morphs, twists, turns, and fires so fast it's hard to keep up. But that's exactly why we love it. For the lowdown on the latest in PC entertainment, DVDs, consoles, and just stuff we love, read on.

Neverwinter Nights
D&D Third Edition Rules In The Forgotten Realms

"Potential" is the word that best summarizes Neverwinter Nights, the latest RPG to be developed by the folks at BioWare. At first glance you may be tempted to think this is a Diablo II rehash; rest assured that it is not.

There are a few key pieces to NWN: The massive single-player component played with D&D 3rd Edition rules is similar to past BioWare RPGs, the Neverwinter Aurora Toolset which BioWare used to build the single-player game lets anyone create full-fledged campaigns, scripts, and dungeons, and the innovative Dungeon Master Client lets a player control all aspects of the gameworld while others play. Naturally, the DM will be creating dungeons using the Aurora Toolset.

NWN has lots of depth, but even an RPG novice will have little problem starting out.

The single-player game alone justifies the price of entry for any RPG fan. Here you control your main character and can recruit one henchman, which may take some getting used to if you've played other BioWare RPGs. Give the game some time and you'll be amazed with the variety of monsters, quality of graphics, and storyline. But it's the toolset and DM features that give NWN its potential. (Just remember to grab the 37MB patch before you start.) Many will find the true joy of the game in the custom DM dungeons when played along with up to 64 of your friends.

BioWare includes 60 to 80 hours of gameplay in the single-player campaign.

You'd be remiss to skip NWN if you have even the slightest interest in RPGs.

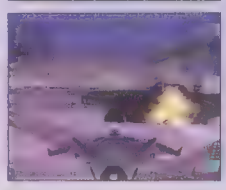
Neverwinter Nights (PC)

$59.99
Infogrames
www.neverwinternights.com

Check These Out On The Web

See our reviews of **Men In Black II: Alien Escape** (PS2), **Dropship: United Peace Force** (PS2), and **Burnout** (NGC, PS2, Xbox) at www.smartcomputing.com/cpumag/sep02/gamereviews.

Take on the role of the fast-talking, free-wheeling agent J in Acclaim's **Men In Black II: Alien Escape**.



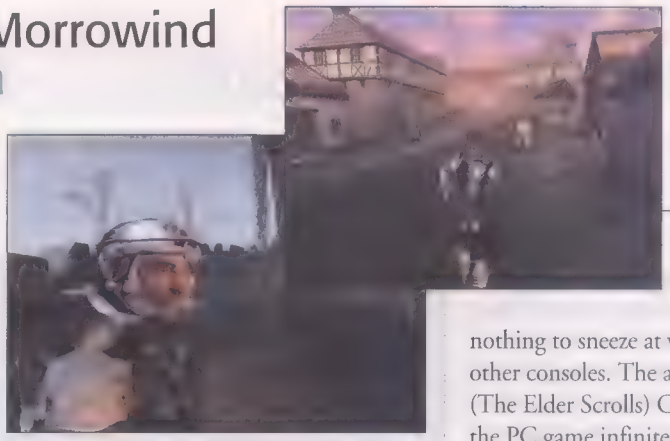
In Bam! Entertainment's **Dropship: United Peace Force**, you'll fly several configurations of dropship aircraft, pilot ground vehicles, and take control of allied forces to achieve victory.

If you want high-speed racing with spectacular crashes, **Burnout** could be the game for you.

The Elder Scrolls III: Morrowind
Third Time's A Charm

In 1993 Bethesda released an RPG of grand proportions: The Elder Scrolls: Arena. Only the epic number of bugs that detracted substantially from gameplay eclipsed the massive game world. The sequel, Daggerfall, was released in late 1996, again with its own set of killer bugs (one which even deleted system files). Both games were imminently playable for hardcore RPG-ers after applying substantial patches. Fortunately, Morrowind takes a great leap forward in graphics, audio, game design, and gameplay while minimizing creeping arthropods.

Morrowind is smaller in scope than Daggerfall, but that's not saying much. This game is leaps and bounds bigger than the other competing RPGs around. The lands you'll traverse no longer have the generic look of Daggerfall. Everything you see in the living, breathing world of Vvardenfell has been placed there by the game's designers; you can easily lose yourself in it for hours at a time. Morrowind, like its predecessors, is completely open-ended. You can finish the main quest and put the game away without any further exploration or rather chose not to follow the main quest that's laid out. The interface is intuitive, and inventory management is quite simple; the lack of a major on-screen interface keeps the game world in view just as it should be.



Morrowind on the PC is more expandable and features much higher quality graphics . . . but the Xbox version (while looking good) will be imminently more playable on your couch over the next few months.

We do have a few bones to pick. Moving through the terrain is slow even when you're running. Keeping in mind how much land there is to cover, many gamers may be prematurely turned off. Furthermore, the journal needs a more organized way to keep objectives and goals in order. As it stands, it feels as if you have to wander through hundreds of pages in search of notes and quests. A bookmarking feature would be very welcome indeed.

We've racked up many days playing both the PC and Xbox versions and have found them equally addictive. It's not surprising that the gorgeous graphics look substantially better on a high-end rig, but the Xbox is nothing to sneeze at when compared to other consoles. The addition of the TES (The Elder Scrolls) Construction Set gives the PC game infinitely more longevity because fans can create mods and add-ons for the game with a little practice. Bethesda is also making plug-ins, patches, and utilities available on the Morrowind site.

The Xbox version, which is the same as the PC version, makes good use of the Xbox hard drive. We found ourselves spending more time on the Xbox because lolling on the La-Z-Boy was far more comfortable than sitting at our desks. The La-Z-Boy is a huge benefit when playing a game that can last for substantially more than several months. Looking for suspension of disbelief and want to lose yourself in another world? Look no further.

The Elder Scrolls III: Morrowind (PC, Xbox)

$49.99
Bethesda Softworks
www.morrowind.com

DVD Byte by Todd Doogan

Quentin Tarantino redefined film in the '90s, made it cool to talk about pop culture, and hasn't made a movie in five years. His style has been riffed on and aped ever since he made his directorial debut with the searing "Reservoir Dogs" back in 1992. It's a decade later, and his impact on world cinema can still be seen. And in case we're apt to forget his power as a filmmaker, his two best films, "Pulp Fiction" and "Jackie Brown," are coming to DVD this month.

Presented in luscious anamorphic widescreen and in grooving DTS 5.1 sound, these two-disc special-edition DVDs are must-haves. "Pulp Fiction" includes a handful of deleted scenes along with an extensive grouping of supplemental features, including a grand making-of documentary, an episode of "Siskel and Ebert At The Movies," behind-the-scenes footage, trailers, still galleries, and a collection of articles and film reviews.

"Jackie Brown" is even more in-depth. Along with a fascinating documentary and long on-camera interview with Tarantino, there are some deleted scenes, footage from the cast's appearance on MTV's "TRL," trailers for pretty much any film made by Robert Forester and Pam Grier, plus much, much more.

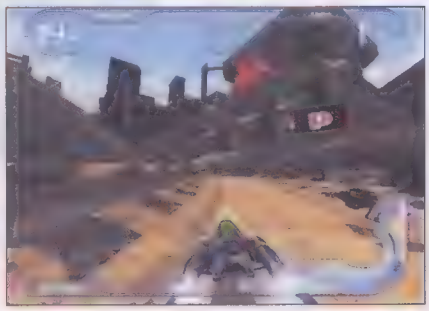
Sadly, there are no Tarantino commentaries for either of these films, but there is a subtitle trivia feature that runs the length of both films and turns out to be just as informative as any commentary track. Not only that, but a DVD-ROM feature lets you play trivia and read the script as you watch the films. All in all, these are two great DVDs any fan should own. And if your hankering for Tarantino needs further whetting, Artisan has also released a double-disc set of "Reservoir Dogs," and Warner is releasing the Tarantino-scripted "True Romance." It's a good time to be a Tarantino fan.

Wipeout Fusion
Another Classic Gets A PS2 Facelift

Psygnosis' original Wipeout title was one of the first PlayStation games to show off the promise of 32-bit gaming and now it's back, although hardcore fans of the series will notice some differences. Not too surprising, as Psygnosis itself is no more and the original development team has moved on to other things, but worth mentioning nonetheless.

For one thing, Fusion offers a wider variety of track environments, including desert scenes, arctic areas, and waterfalls, as well as the usual high-tech industrial backgrounds. The game also includes more ships and weapons and lets you upgrade ships as you go.

These tweaks aside, Wipeout Fusion falls pretty close to the tree (which isn't necessarily a bad thing), consisting entirely of choosing antigravity racing ships and pilots and flying around well-designed tracks at breakneck speed. The soundtrack is still packed with driving techno beats that seem to set the right tone, the tracks are still festooned with loops and dizzying drops that sometimes make you catch your breath, and you still have to watch your back. AI and multiplayer opponents have access to the same considerable array of guns, grenades, missiles, and other weapons you do, and they'll ruthlessly use them to get a leg up on you throughout each race.



Wipeout Fusion's detailed tracks and sharp, fast graphics add up to a great racing experience.

Of course, as with any PlayStation sequel to appear on the PS2, Wipeout Fusion sports vastly improved graphics. Everything on-screen looks much smoother than before, and any aliasing that might appear from time to time will flash by so quickly you won't have time to notice, thanks to a pretty steady frame rate. The game also provides solid control and doesn't take long to learn.

Wipeout Fusion doesn't really break any new ground, but fans of the original series or folks looking for fast-paced racing with a futuristic twist will enjoy this game.

Wipeout Fusion (PS2)

$49.99
Bam! Entertainment
www.wipeoutfusion.com

Xbox Controller S
Get A New & Improved Grip

When Microsoft launched its superb Xbox game console in the United States late last year, the hardware met with rave reviews. It has just about everything you could ask for in a console, and its control pads are well-built, highly functional units with plenty of solid buttons and great analog control sticks. When the company released the console in Japan in February, it included a redesigned controller with several handy differences, the biggest one being its smaller size.

U.S. gamers and pundits that got to use the Japanese controllers liked the smaller format, and Microsoft responded by releasing the Controller S here in the States. Controller S is smaller than the original and incorporates several differences in button layout, most of which we like very much. This is not to say that we aren't fond of the original, but as many gamers can attest, if you're used to playing with PS2 controllers (and, frankly, most any other console controllers), the Controller S makes for an easier transition into the wonderful world of Xbox.

We spent lots of time playing our favorite Xbox games (read: Halo) with both controllers, and although both get the job done nicely, the Controller S provides a little more comfort because you don't have to reach quite as far to reach its triggers, etc. This translates into less hand fatigue over extended periods of play. The other thing we like about Controller S is its tweaked button layout. The green, red, blue, and yellow A, B, X, and Y buttons have greater separation, which means less inadvertent button presses in the heat of battle.

You'll find Controller S' black-and-white buttons below A, B, X, and Y instead of above them, which takes some getting used to. The Controller S also has a larger concave indentation on the top of the right analog thumb stick, and its D-pad is shaped more like those of traditional controllers, but we approve of all these changes. In fact, the only minor complaint we have with the new controller is that Microsoft put its Start and Back buttons on the left side beneath the left analog control stick instead of leaving them in the middle of the pad, but this is a small issue. Long story short, preference is a funny thing, and both controllers will likely be in high demand throughout the life of the Xbox.

Controller S is considerably smaller than the original control pad and has some interesting differences where button layout is concerned, as well.

Controller S (Xbox)

$29.99
Microsoft
www.xbox.com

Hot Shots: The Beauty Of The Game

Yeah, we know it's all about the gameplay. Sure, there are those who would have you believe graphics are relatively unimportant in the greater scope of things, but if you read *CPU* mag, you probably already know those folks are off their collective rockers. We want great gameplay combined with stunning graphics, and here are two upcoming games that show promise. Watch for them.

Haegemonia (PC). The developers behind the Imperium Galactica games, Digital Reality, are hard at work on a visually tasty sci-fi strategy game inspired by such heavyweights as Homeworld and Master of Orion, to name only two. Publisher Dreamcatcher Interactive hopes to have this title on store shelves later this fall, and we can't wait. For more details, please visit the Web site at www.haegemonia.com.

Star Trek Starfleet Command III (PC). Those of you in need of a realistic "Star Trek" space battle should ready yourselves. The graphics engine is a big jump up from Fleet Command II, and that makes it all the better for taking the bridge in the dynamic campaigns and multiplayer games. Star Trek FC III is being developed by Taldren for Activision. Expect to take command this winter. (And don't miss "Star Trek: Nemesis" at your local cinema.)

Infinite Loop

Even A Kindergartner

It seems that even a kindergartner—probably even a preschooler—can thwart Sony DADC's market-leading key2audio anticopy protection for CDs. All it takes is running a black permanent marker around the outer edge of a CD's underside. The result might cause a hiccup in performance, but press Play an additional time or two, and the CD is ready to play and be copied.

- Cost to use key2audio technology: Undisclosed, but presumably it's a lot.
- Cost of a BIC permanent marker: Approximately $1.49.

- Number of key2audio-protected CDs on the market: More than 21 million.
- Number of BIC permanent markers sold daily: We don't have a number specifically for permanent markers, but with 14 million BIC pens sold worldwide each day, it has to be a lot.

Can you say, "David vs. Goliath"?

Sources: Reuters, Sony

Software Tips & Projects

Burn DVDs On The Cheap

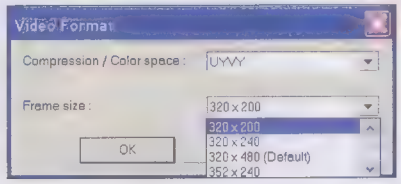
STILL WAITING FOR THOSE DVD BURNERS TO DROP BELOW THE PRICE OF A WEEKEND IN THE BAHAMAS? OR ARE YOU JUST PLAYING IT CLEVER AND COY WHILE DVD-RW and DVD+RW formats battle over which will be the industry standard? There is no need to wait. You can start honing your DVD authoring skills now, even if you don't own a pricey burner: A standard CD-R/RW drive can write DVDs, too.

Although the 650MB of real estate available on a CD-R may seem puny compared to the full-bore 4.7GB on a DVD, we discovered that by applying a few smart space-saving techniques to the usual process of assembling a DVD project, a CD-R/DVD can hold a surprising amount of video material. CD-R/DVDs will play on any PC with a DVD drive and software DVD player, such as WinDVD or PowerDVD, and even on some newer standalone DVD players that handle the MiniDVD format. As always, remember to keep it clean and legal. Stick to public domain, noncopyrighted material and your own backlog of personal videos.

We cooked up our DVDs on CD-R media with just a few essential ingredients. Although your disc media and burner can be standard issue (a 650MB disc and any CD-R/RW drive), you do need DVD-authoring/writing software in order to design the project, then encode and burn it to your CD-R in the proper MPEG-2 DVD format. We used Ulead's new DVD Workshop ($279; www.ulead.com) because it writes DVD formats onto CD-R/RW media effortlessly. You can download the trial version and test some of the design concepts we tried here without spending a dime. Finally, make sure you have a lot (and we mean a lot) of free hard drive space. Both the video capturing and final processing of the DVD will require several times more hard drive space than the 4.7GB DVD itself.

Capture Wisely

The majority of DVD authoring is divided into four discrete steps: video capturing, clip editing, menu creation, and processing/burning. When capturing video streams from an analog video card, keep in mind that it is wasteful to record the clip at any resolution higher than the original. For instance, we connected a VHS deck to the composite inputs of our ATI All-In-Wonder RADEON card to grab some home video. The Ulead DVD Workshop (DVDWS) recognized the feed and, under its Capture Settings/Video Format menu options, let us set the recording resolution anywhere from 80 x 60 to DVD-quality 720 x 480 and the Audio Format from 8-bit mono to 16-bit stereo.



Avoid capturing video material at a higher resolution than the original, as this just wastes hard drive space and processing time on the back end of DVD encoding.

Recording at DVD quality, a single minute of VHS tape produced a raw file of 1.17GB! Although this file *is* compressed substantially in the final MPEG-2 encoding, the capture files can eat up a staggering amount of hard drive space and bandwidth, which can result in dropped frames. Most importantly, the final DVD video quality was not discernibly better than capturing the same minute of video at 320 x 200 resolution and 8-bit mono sound. This gave us a more manageable raw file size of 228MB and took much less time to encode in the final part of the process.

Top-level authoring software packages such as DVDWS have built-in "transcoding," which converts and compresses most digital video formats (AVI, MP3, MPEG-1) into a standard DVD format (MPEG-2) in the final part of the process. Predicting how much raw video material of different types will encode to fit onto a 650MB CD-R is a dark art indeed, and as we will see, it involves the video quality at which you choose to burn your project in the final stage. As a rule of thumb, we found that a CD-R held close to 30 minutes of VHS-quality footage. For instance, our 18-minute home video was captured as a 4GB AVI file but encoded down to a 578MB DVD project, which included minimal menus. Another project, involving imported MPEG files totaling 34 minutes, produced a 680MB DVD when we burned the project at a 352 x 400 resolution, which is higher than standard TV formats. Bottom line: Aim to squeeze 20 to 30 minutes onto a CD-R.

Cut & Tag

The editing process is where you can both save disc space and also maximize the convenience of your DVDs. In our 18-minute grab from a home VHS tape, we started with a single "title." Titles are the raw pieces of footage you pull into a DVD project and from which you can assemble the discrete clips for this DVD. You then

assign to each title one or more "chapters," which are the indexing points on the disc that allow the end user easier navigation.

In the Edit mode in DVDWS, highlighting any title on your storyboard of captured or imported video brings it into the preview screen. From there, you can trim it by establishing Mark In and Mark Out points, the spots on the title where you want the action in the final DVD product to begin and end respectively. Our title had a good 15 seconds of video garbage from the beginning of the VHS tape and dead air when no people entered the scene. Using the Jog Bar, which lets you move frame by frame in a title, we found our desired starting point and used the nearby Mark In button to tell DVDWS where to start the scene in the final video mix. We used the Jog Bar and Mark Out command to set an end point in the title, as well, shaving off unnecessary video time and making more room on the disc.

Like all authoring programs, DVDWS also lets you chop lengthy titles into smaller pieces. For instance, in our 18-minute home video grab, we used the Jog Bar to locate the beginning of a stretch in the video that could be excised. The Cut Title command divided the title in two at that point, so that we could use the Mark In/Mark Out commands to shave even more unnecessary footage from the ends of the newly clipped titles. By dividing our original 18-minute opus into five smaller trimmed titles, we cut almost five minutes from the project, making more room for other clips. In the menu-making stage, we will be able to turn each of these edited titles into a discrete video clip with its own thumbnail and button on the top menu.

To maximize the advantages of navigating a DVD, you may want to insert "chapters" liberally within each title. These are the indexing marks that professional DVD makers usually plant at major scene changes in a film so that the end user can jump forward or backward in modest increments. Every title on your storyboard is automatically a single chapter. In DVDWS, you can add chapters to a title by locating the scene change you want to mark with the Jog Bar and then using the Insert Chapter button in the command menu. For our Christmas morning video, we inserted chapters to mark the opening of each new present. Thumbnail images for each of these chapters then appear in the vertical Chapter List on the right of the screen. Later, we can make these thumbnails into illustrated navigation buttons in the top menu for our DVD.

Before starting the menu-making process, you need to decide whether your DVD will have a "first play" element, which is what a disc player loads automatically at start and before the main navigation menu. In the DVDWS program's Edit mode, you drag and drop any static image or video file onto a special First Play box in the storyboard. Leaving the First Play title space empty, however, will save disc space and make the DVD start simply by loading the main menu at start.

Use the Jog Bar to isolate any frame in your video title. Then you can use the Cut Title command (upper-left pane) to split your title into multiple clips, or you can use the Insert Chapter command to set another indexing point in the title.

Make Mini Menus

Elaborate, animated menus are neat on commercial DVDs, but on homebrew CD-R/DVDs, they can devour disc space. For our DVD, we kept the menu overhead down to about half a megabyte by using a basic illustration for background, simple thumbnails as menu buttons, and an old MP3 music file on our hard drive as music accompaniment. When you first go into the Menu mode, DVDWS let you choose a standard template, a background with a preset number of menu button placeholders. You can easily delete excess placeholders later in the menu-making process, so just choose a format that approximates the number of menu buttons you will need to

WinXP Tip Of The Month

The Hard Drive Hustle

You just added a second hard drive to your PC, but because of the way WinXP automatically assigns letters to drives, the arrangement is not to your liking. Your first hard drive occupies C: and D:, your CD-ROM is E:, and the new hard drive is assigned F: and G:. In order to change drive letter assignments in XP, use the much-ignored Disk Management tool. At the Start menu, right-click My Computer and choose Manage. By the way, advanced users will find a trove of configuration tools in this Computer Management window that pops up. For now, you want the Disk Management tree, where you will find a list of available drives.

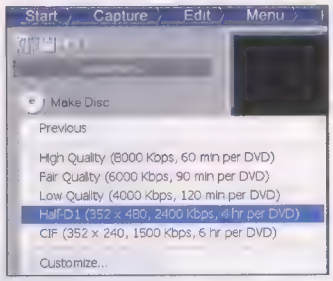
To reorder these drives, you need to remove the current drive assignment from the CD-ROM. Right-click the CD-ROM drive in the lower-right pane and use the Change Drive Letter And Paths command. In the window that pops up, click Remove. Now the E: assignment is free to use, so right-click the F: drive and follow the buttons to change its letter to E:. This in turn frees up F: to assign to the G: partition. Once all of this is done, don't forget to go back to your CD-ROM and Add its new drive letter, in this case G:. ▲

access the major scenes in your video. We chose a template that would allow thumbnails for each of the many chapters we created across the four titles in our DVD, so the main menu was itself a kind of storyboard the viewer could drop into many given points.

We needed to make a basic choice in navigation design. We could give just four top line menu buttons, one for each title in our production, and then let the user navigate forward quickly within each title via the numerous chapters we had established. But because we were dealing with only 15 minutes of video, we chose instead to make each of our chapters a menu item with its own thumbnail on the main menu. This way, the end-user could jump down to any scene directly from the opening screen. With the menu template on-screen, use the Chapter List to cycle through the various chapter thumbnails you made in Edit mode. Dragging and dropping these images into the open slots in the menu automatically links the thumbnail to the correct chapter on the disc.

Menu creation is a simple matter of dragging and dropping any of the chapter thumbnails you want to use as top line navigation points onto the menu screen. The authoring software automatically links the thumbnail to the correct piece of video.

The menu creation screen works much like a paint program. By navigating tabs in the command area on the left, you can add descriptive text anywhere for labeling, delete unnecessary elements, and tinker endlessly with the appearance of your buttons. In our experience, most of these static additions add little to the amount of disc space the menu itself takes up, so feel free to play. It is the addition of motion of any kind that tends to bulk things up and add tremendously to the final processing time. We did add background music for our menu simply by using the Media Library folders (in the lower left) and locating the right MP3 on our hard drive. Dragging that audio file from the library and onto the menu frame embeds the music so that it plays when the menu is on-screen in the final DVD.



As with any media recording, you can trade off available playtime for recording quality. For low-resolution projects such as VHS transfers, lower quality settings still capture all the image detail from the original.

It's All In The Burn

When making a CD-R/DVD, the real space savings will come from lowering the video quality at which you record the project to disc. In DVDWS, the Finish mode is where you can preview the project as it will appear in final form and then burn the image. The program offered us five quality levels, from an 8,000Kbps stream that only gets 60 minutes of video onto a full DVD disc, to a 352 x 240 resolution stream that can put 6 hours of material on a DVD. Again, don't bother recording at a higher resolution than the original material. Now trimmed to about 15 minutes of video and sporting slim menus, our project required 492.2MB of disc space when recording at a "Low" quality setting (4,000Kbps), but this was still higher than necessary to get all the detail of the original VHS video. We reduced that project size to 297.4MB by lowering the recording quality to a 2,400Kbps stream (352 x 480 resolution), which could end up fitting nearly 40 minutes of video on a single CD-R.

You will want to test which level of DVD video quality is acceptable for your source material. One way of doing this without wasting CD-Rs and burning time is to have the program burn your project first to a DVD directory on your hard drive, which is one of the options in the Make A Disc submenu. You can view these files with your software DVD player in order to get a better idea of how the video quality is translating.

Once you decide on the proper video quality, it is time to fire up the laser. If your burning program does write to CD-Rs, it should recognize the media size of your blank disc in the drive as 650MB. Be forewarned: In order for the authoring program to encode all of those menus, video, and audio clips into the DVD format, it will need loads of hard drive space and time. Be ready to wait. DVD encoding for a 650MB CD-R can take over an hour of your processor's time.

The final disc complies with the "Mini-DVD" format, which lets CD-R media hold and play DVDs. It should play in any software DVD player or the most recent standalone DVD players that support MiniDVDs. CPU

by Steve Smith

Infinite Loop

Ooh La La!

Consumers continually gripe about inkjet ink prices. But how does the cost of ink compare to the cost of other liquids in the world's vast marketplace?

- **HP Deskjet 940c**
  25ml for $30 ($1.20 per ml)
- **Chanel No. 5 Parfum**
  30ml for $210 ($7 per ml)
- **Mesa Cabernet Sauvignon Napa Valley**
  750ml for $42 (5.6 cents per ml)
- **Budweiser**
  355ml for $2 (0.6 cents per ml)
- **Orange Juice**
  1893ml for $2.70 (0.1 cent per ml)
- **Human blood (Red Cross)**
  about $200 per pint (35 cents per ml)

fig.1

One essential piece of equipment for this game is in your body.

The other is in your computer.

A teeth-grinding adrenaline rush. A grenade-sized lump in your throat. The trigger-tingling sense that someone is watching you. It's all part of the over-the-top realism you'll experience in *Soldier of Fortune 2: Double Helix*. Why? Because this ultra-realistic game was designed for the optimum performance you can only get from a computer juiced with the high-speed performance of an NVIDIA® graphics processor. So plunge into the secret and deadly world of covert operations with the firepower of NVIDIA. And play the game the way it was meant to be played.

The way it's meant to be played
NVIDIA

gamefixx.com

Visit your local CompUSA or log on to www.gamefixx.com/nvidia/

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Warm Up To Penguins

Watch Your Log Files For Intruders

In August's issue of Computer Power User, *we presented tips for working with your command history. This month, and in months to come, we delve into more Linux issues and projects. This month, we focus on protecting your log files.*

Linux stores a wide variety of data about its inner workings in files that are referred to as log files. Even if you've never explicitly set up your software to keep logs, your Linux box likely has been creating them anyway, generating a huge wealth of information about your machine's health, what it's being used for most often, and more. In this age of electronic break-ins, one important use of log files is watching for invasion attempts and successes.

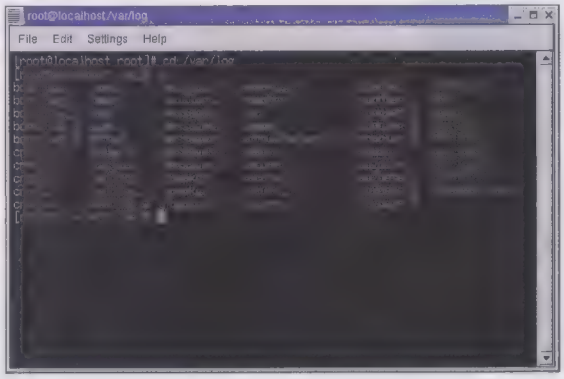
Learning About Logs

Not all Linux distributions set up their filesystems in the same way. According to Filesystem Hierarchy Standard 2.2 (www.pathname.com/fhs), most log files on your Linux system should be in the directory /var/log. Most distributions follow this rule, so try changing to the /var/log directory to get a file listing. You might see something similar to what's shown in the illustration accompanying this article.

According to the standard, there are three log files that *should* appear in every Linux distribution. The file /var/log/lastlog should record the last time each user logged in. The file /var/log/wtmp should store records of every login and logout. In the file /var/log/messages, you should find information that the syslogd program stores, if it's running on your system (many Linux distributions run this tool by default).

There are a number of ways to determine the function of a log file, including the following:

- **RTFM.** Most distributions come with documentation or make documentation available on the Web. Make use of it.



The example here shows a /var/log listing from a system running Red Hat Linux 7.3. Becoming familiar with your log files can help alert you of break-ins, as well as system performance and software problems.

- **View the contents of /etc/syslog.conf.** This file contains instructions for syslogd, including which processes to record information about, how much information it should record, and where it should record it. For more information about how this file works, type **man syslog.conf**.
- **Investigate the filename.** There's no great conspiracy out there to keep you from figuring out your Linux system. If you see a file named /var/log/cron, it is a log regarding the processes that are run at set times by crond. A file that's named kern.log very likely holds data regarding the Linux kernel's operation. In general, use the manual pages to investigate if you aren't sure. For example, if you can't figure out what dmesg is, type **man dmesg**. Note that not all log files are named after a command.
- **Check the contents.** Make liberal use of the less command, such as less messages. If you get a bunch of garbage, the log file is in a special, nontext format. The manual page should be able to help with that. For example, you can't view the contents of wtmp directly; you have to type the **last** command.
- **Check the configuration files of other software.** If you're running a Web server, such as Apache, tell the server where to save its logs and in what files to save it.

That's A Copy. That's A Copy

You might notice that your /var/log directory contains files that appear to be the same file listed multiple times but with some files having numbers on the end. For example, you may see messages, messages.1, messages.2, and so on. If this is the case, you might be running a tool such as logrotate, which watches your log files for criteria that's specified in /etc/logrotate.conf and, when the time comes, runs the listed tasks on the files.

Often, after either a certain number of days or after the file reaches a certain size, logrotate will rotate a log file by advancing through a numbered queue.

GNOME 2.0 Is Here

For you GNOME fans, GNOME 2.0 is now available. If you plan to upgrade, take a look at your distribution's update sections first to see if you can download the software from there. This lets you make sure that the change will mesh well with your distribution's package management scheme. In addition, you can go directly to www.gnome.org to find downloadable packages for a variety of distributions already set up. Of course, the source code is also available for those who like to make things as difficult as possible for themselves. ▲

The original /var/log/messages eventually become /var/log/messages.1, and a new, empty /var/log/messages file is created and loaded. There is a limit to how many of these files your system will keep around. Again, logrotate has this information set in its configuration file. In the end, the final file might be rotated out of existence (meaning it's deleted) or compressed and archived elsewhere. The logrotate utility is typically handled by crond.

The Innards Of A Log File

Now that you can find your log files, identify what they belong to, and decipher any strange goings-on in the directory, it's time to learn how to read what's actually in the files. You might find this information at the start of /var/log/cron, such as the following example:

```
Jun 30 04:04:59 chick
CROND[29049]: (root) CMD
(/usr/bin/mrtg /etc/mrtg/mrtg.cfg)
Jun 30 04:10:00 chick
CROND[29052]: (root) CMD
(/usr/bin/mrtg /etc/mrtg/mrtg.cfg)
Jun 30 04:10:00 chick
CROND[29053]: (root) CMD
(/usr/lib/sa/sa1 1 1)
Jun 30 04:15:00 chick
CROND[29056]: (root) CMD
(/usr/bin/mrtg /etc/mrtg/mrtg.cfg)
Jun 30 04:20:00 chick
CROND[29059]: (root) CMD
(/usr/bin/mrtg /etc/mrtg/mrtg.cfg)
```

Looking at these lines from left to right, it's clear that the start of the lines (Jun 30 04:04:59, for example) represents the date and time the log entries were made. The second portion of the line (chick) is the hostname of the machine the log entry applies to. It is possible to send log entries to a different machine on a network, such as a log server. The third portion of the line is the name of the program that's being logged. In this case, because we chose /var/log/cron, all of the entries will end up CROND.

The numbers in brackets (such as 29049) represent the PID (process ID) that crond was running under at the time it issued the command. In the parentheses you'll find the user that the daemon ran the command as (in this case, root). Finally, you'll see the command itself. Mrtg in this example is the Multi Router Traffic Grapher (www.mrtg.org), a program that monitors traffic loads on network links.

Logging & Log Analysis Tools

Now that we understand the basics of what a log file is, we can get to the meat of the issue. Some Linux distributions run log analyzers by default and even email the root account a summary of what they find. If this is the case, you are ahead of the game, and you may not feel the need to change anything. However, if you want to build you own system, there are a few useful tools that can help.

First, let's look a bit more at logging. As mentioned earlier, the default logger in Linux tends to be syslogd. However, syslog-ng (www.balabit.hu/en/downloads/syslog-ng) is another tool that gives you a lot more flexibility and one that's building a growing fan base among Linux and Unix users.

With syslogd, you are limited to determining what gets logged, to what location, by what service the information comes from, and the priority ranking. Syslog-ng allows for a much more fine-tuned sorting process, letting you sort messages into files by their actual content. The more organized your log files are, the easier it is to spot problems.

Then there are log analysis tools. The analyzer often used in Linux by default is logwatch (www.logwatch.org). You configure this tool through the logwatch.conf file with the help of the HOWTO-Make-Filter file that installs with the tool. (You'll probably need to use the find or locate commands to track this one down.)

A tool that offers more flexibility is logsurfer (www.cert.dfn.de/eng/logsurf). This program can handle multiple lines of input, more subtleties than logwatch, and has built quite a following in general.

With either program, the key is learning to recognize the issues you need to watch for. The documentation for both these programs is quite instructive; you might find it useful to read both just for the examples. You'll also do well spending some time becoming familiar with your log files. Get to know what's normal content there, and research the entries you don't understand. The more time you spend doing this, the better the filters you can build for your log analyzers and the more likely you are to spot something notable with the naked eye.

Log Up

We don't watch our logs just for potential break-ins. Log files can also warn us of deterioration in our system's performance, software problems, and more. If you think it's a pain to have to dig manually through your log files, set up an analysis tool to remind yourself that the time you spend learning about your logs will help you fine-tune your analyzers so you don't risk missing something. In addition, your less log-savvy friends will love you for sharing the fruits of your labors. CPU

by Dee-Ann LeBlanc

harman/kardon®

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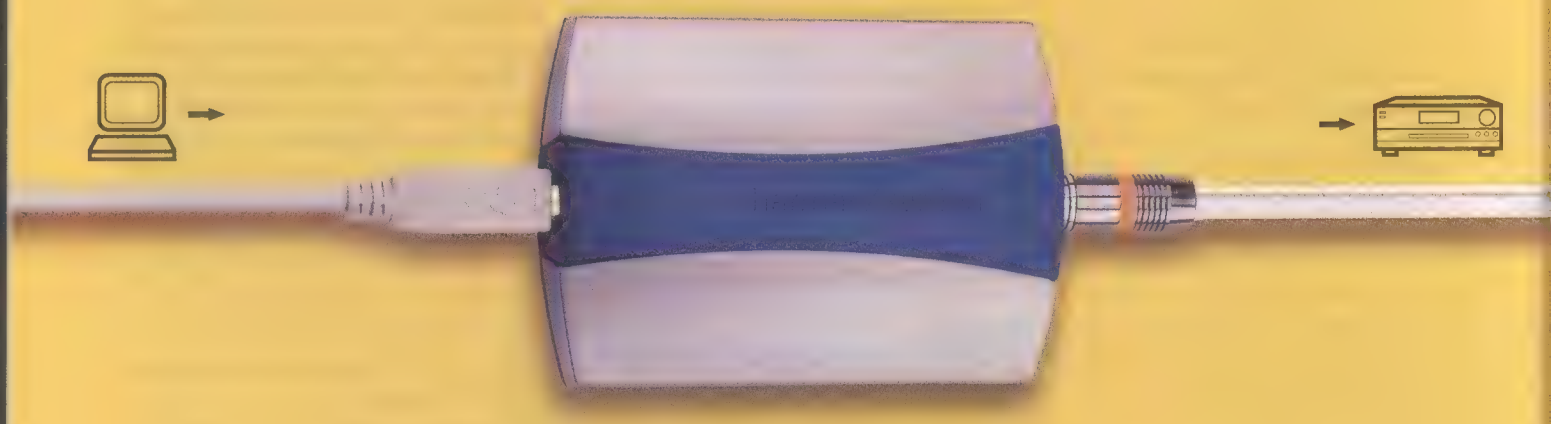

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Killer Hardware Tips

Too Cool To Follow Rules

If you're a user who can't leave things alone if there's a chance you can make them better, even if it means bucking the norm, read on. We have some tips and tricks that just might make you more productive.

We Don't Need No Stinkin' Badges

A case badge is a tiny, 1-inch-square piece of real estate on a PC's front that most users pay little attention to. It can be, however, the signature of your PC.

If you're ready to change the corporate logo that's marring your PC's face, replace it inexpensively and easily with something better suited to you. Sites such as PC Case Gear (www.pccasegear.com) sell dozens of badges, with logos extolling the virtues of Linux, pirates, and more.

You can also rev the badge up using a light kit, which shines through a clear badge or provides eerie backlighting to an opaque badge. Kits are available from online sellers such as Gamerz Stuff ($12; www.gamerzstuff.com/badgelite) and Directron.com ($9;www.directron.com/badgelight.html).

Adding a light badge to your PC's box is one of the easiest case mods there is.

Kits usually include a LED mounted to a 1-inch square of white plastic, a four-pin power supply unit cable, and self-adhesive paper. Installation entails connecting the LED's power cable to a hard drive power connector, drilling an installation hole where you want the badge, and installing the light. (You can also place the badge in a blank drive bay cover.) Finally, stick on your self-adhesive badge. Dan's Data Web site has an installation guide at www.dansdata.com/badgelite.htm.

You can also print your own logos using adhesive labels. You'll need a clear cover that instantly turns the sticker into an authentic PC badge. Try www.directron.com/clearbadge.html for cover options.

Four badge choices from PC Case Gear. This square inch of PC real estate is a great place to exercise your right to liven up your PC's case.

Hack The Xbox

As long as there have been video game consoles, there have been users pushing what consoles can do. From Game Genie (added lives and hidden features to Nintendo games) to Starpath Supercharger (increased Atari 2600 RAM from 128 bytes to a whopping 6,272 bytes), users have expanded their consoles' capabilities.

This pattern continues for the Xbox. Perhaps the most popular method of Xbox modding is with a mod chip, a hardware hack that tricks the CPU into doing things Microsoft didn't intend.

Two brands of Xbox mod chips include Xtender (www.xtender.info) and Enigmah X. The maker of the Enigmah chip has gone out of business, but the chip is still available from many resellers. Both chips let users play imported and copied games, run custom code, and use CD-R, CD-RW, DVD-R, and DVD-RW media.

Using a mod chip, an Xbox can run "unsigned" code or programs without Microsoft's encrypted stamp of approval. Such code lets developers home brew custom software.

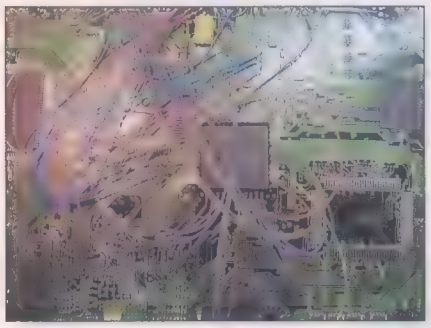
It almost goes without saying that one group is working on porting Linux to the Xbox. The Xbox Linux Project (xbox-linux.sourceforge.net) aims to create a version of GNU/Linux for the Xbox, letting users use the console as an ordinary computer. The project is still in the early stages—there is barely a working bootloader—but it ultimately could make home-brew game development easier or let you use the Xbox as an inexpensive server machine.

For movie buffs, Xbox mod chips disable Macrovision copy protection for DVDs. Neither chip will let you play DVDs from outside your region, however. For that, you need an official DVD kit from Microsoft for each region you want. However, the mod chips include a region reset function that prevents the Xbox from being locked into a single region.

The cost of the chips is about the same. At Lik Sang International (lik-sang.com) based in Hong Kong, the Enigmah X is

about $69 and the Xtender about $79. U.S. company GameGizmo.com (www.gamegizmo.com) sells a nonsocketed version of the Enigmah chip for $35 and an onboard, socketed version for $69.

The chips aren't PnP, so be prepared to open your Xbox and solder as many as 29 wires to the motherboard. "Installing a mod chip is not really easy," says Alex Wong, Lik Sang customer support executive.



With a mod chip installed, an Xbox motherboard is obscured by a maze of wires.

Image courtesy of GameGizmo

John Jury, business development manager at GameGizmo.com, says, "You definitely need soldering experience." Although none of his customers have killed their Xbox attempting to modify it, "I won't rule it out that it can't happen," Jury says.

You can also buy a unit already modded by a pro. Lik Sang sells such Xboxes with Enigmah for $339 (about $140 more than a vanilla Xbox from a U.S. retailer).

Although mod chips are generally synonymous with console game piracy, that generally hasn't been the case with Xbox mod chip buyers, says Jury. "It's not so much about pirating games because there really is no way for most home users to copy games. A lot of our customers are interested in home-brew development. They're getting this because they want to program or port an emulator over to the Xbox."

"Most mod chips go to developers or people who want to start programming for the Xbox," Wong says.

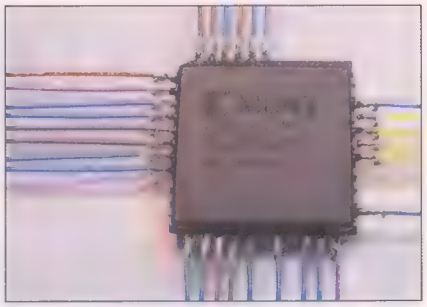
Once you decide to chip your console, you need a mod chip. From a player's perspective, "All the chips are the same," Jury says. "It's not like the Playstation 2 where you have 12 models of mod chips that all do different things. For the Xbox, they all pretty much do the exact same thing." From a shopper's perspective, consider the Xtender, which is still supported by its maker. Enigmah's features are still popular, but its price may rise as supplies dwindle.

Although functionality is similar, there are technical differences. "The most popular one seems to be the Enigmah," says Wong. "It is actually the same as the Xtender, but the [Xtender's] small disadvantage is that the BIOS needs to be identified and configured via a solder-jumper before you install it."

"Enigmah seems to patch the Xbox ROM on the fly. Xtender is a replacement hacked ROM and contains Microsoft copyright code, so Enigmah is preferable for legal reasons," says Dan Johnson, founder of XboxHacker.Net. Other mods don't involve a mod chip. The "resources" section of XboxHacker.net lists several types, including enhancing video output and disabling the parental lock function.

"There have been circuits developed to get VGA output from the Xbox. There was a tutorial on the XboxHacker BBS about tweaking the DVD drive to read CD-Rs by adjusting the gain. Files can be taken from the Xbox hard drive and the nickname of the Xbox edited," Johnson says.

Other Web resources include The Xbox Forums (www.worldxbox.co.uk), XboxHacker.com (xboxhacker.com), and Xbox Hackz (xboxhackz.com).



Installing the Enigmah mod chip isn't for the faint of heart; it can require 29 solder points on the chip and Xbox motherboard.

Image courtesy of GameGizmo

For multiplayer gaming, unofficial online communities may prove interesting. XBConnect (www.xbconnect.com) and XpluggedIn.com let you play online games against far-off opponents. Both run on a Windows PC (Linux and Mac OS X versions are planned). Connect your Xbox to a PC and the software tunnels Xbox data through the Internet connection. Both apps are free and have been running for months. Microsoft's online gaming system, Xbox Live (www.xbox.com/live), is still in beta. CPU

by Kevin Savetz

Infinite Loop

Fast & Furious

In June 2002, Top500.org released its semi-annual list of the most powerful supercomputers on the planet. NEC's Earth Simulator tops the list this time around. The computer can process 35.86 teraflops per second, blowing away the competition. IBM's Blue Ocean computer would have debuted at number three but wasn't announced before the deadline. Here is Top500.org's official top five ranking.

Top 5 Supercomputers*

Manufacturer	Computer	Location	Max Tfps
NEC	Earth Simulator	Earth Simulator Center, Yokohama, Japan	35.86
IBM	ASCI White	Lawrence Livermore National Laboratory, San Francisco, Calif.	7.22
Hewlett-Packard	TeraScale	Pittsburgh Supercomputer Center, Pittsburgh, Pa.	4.46
Hewlett-Packard	Tera	CEA, Bruyeres-le-Chatel, France	3.98
IBM	SP Power3	NERSC/LBNL, Berkeley, Calif.	3.05

*As ranked by Top 500 Supercomputer Sites, June 2002

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Technically Speaking

An Interview With Richard Stallman, Inventor Of The GNU OS

When we asked Richard Stallman—founder of the free software movement and the man behind the GNU operating system—for his official title, he replied, "I'm an untitled work in progress." No comment could better sum up this unconventional programmer who defies every stereotype in the software industry. Bushy-haired and frugal, Stallman was a brilliant, yet antisocial, discipline case early on, learning calculus by age eight and hopping between public and private schools.

Today, Stallman's Web site (www.stallman.org) is a sprawling list of political warnings and calls to action, and his decades-long work with software is devoted to freeing people from the shackles of corporate agendas. There are few true idealists in the world, especially in the fields of technology, but Stallman left us feeling we'd finally found the genuine article. ▲

by William Van Winkle

CPU: We know the acronym GNU is recursive and stands for "GNU's not Unix," but is there some other inspiration behind "GNU?"

Stallman: No, nothing other than the system it's the name of. Why did I choose GNU instead of BNU or LNU? Because GNU is the funniest word in the English language, and the others are not words.

CPU: Why is GNU the funniest word?

Stallman: Because of all the wordplay it's used in. Ever hear the song "I'm a Gnu" by Flanders & Swan? You should look for it.

CPU: You've strongly noted that the term "Linux" shouldn't be mixed up with GNU. Why?

Stallman: GNU is an operating system that we began developing in 1984, the goal being to have an operating system that was entirely free software so that users would be able to have freedom while using it. Linux is the name for a kernel started in 1991 by Linus Torvalds. At that time, the GNU system was almost finished. The main thing that it lacked was a kernel. So once Linux was running, other people put it into the gap in GNU, combining Linux with the almost-completed GNU system to make a complete system.

We didn't make that combination for a number of reasons. One was that we had already started a kernel, and we thought it would be ready in just a couple of years. Second, I asked somebody to take a look and tell me what he thought of Linux. He told me that it was not portable at all and that it was taking after the AT&T variety of Unix, whereas we thought the Berkeley variety was better. And thinking that our kernel would be done soon, I decided we would stick with our kernel and not choose Linux as our kernel. But other people created the GNU/Linux system. As it happens, our kernel took many years to get right. It's working now, and you can, in fact, get it in a system based on the GNU kernel, but back then the version of GNU based on the Linux kernel was the only one that actually worked. After another couple of years went by, we saw this and realized we better start working on improving the Linux-based version of GNU if we wanted to have one that would run.

CPU: Is there any inherent advantage to running a GNU kernel instead of running Linux?

Stallman: Well, we can hope there is. It's a more advanced design based on a micro-kernel and a collection of servers that communicate by message passing, which gives you the ability to do things

like write your own file system, install it, and connect it to a file name in your directory. Then anybody who opens that name talks to your file system. There are some other nice things that you can do. A beginning user wouldn't notice any difference, but programmers can take advantage of these features.

CPU: The goal of the GNU project was to create a Unix-like system, but what was the fundamental problem with just using Unix?

Stallman: Unix was not free software. You normally couldn't get a copy of the source code, so you couldn't study how the program works. First of all, I should explain that free software means you have the freedom to study what the program does, change it to suit your needs, and redistribute either modified or unmodified copies. Free refers to freedom. It's not about price at all. Unix might have been fine if it was free software, but it wasn't. In fact, there was no free operating system at the time, and that was the cause of the problem that we set out to solve. There was no way you could use a computer in freedom at that time. Only having a free operating system would change that, so we had to write one. I made the decision to follow the design of Unix because it seemed like a reasonably good design to follow for technical reasons.

CPU: The free software movement often gets mixed up with the open source movement. Why is this inaccurate?

Stallman: The free software movement spreads a certain collection of ideas about what is right, and that applies to the operating system and applications, as well. This is what you could compare with the open source movement, which is a later derivative of free software, sort of a branch off of it. In the 1990s, as free software became powerful and attractive, we ultimately had millions of people who used it but may never have even heard of the principles behind it. The ideals that motivated us to work so many years to develop a free operating system were unknown to these people. What they knew was that the system was reputed to be powerful and reliable and that you could get a copy cheap. And for these solely practical, nonprincipled reasons, many users took up the system. There started to be a lot of people in the free software community who didn't particularly hold with or had never even heard of the ideals of a free software movement. Some of these people developed substantial amounts of free software for other reasons.

Anyway, in 1998 those people started using the term "open source." For a couple of years before that, though, people had been pointing out that there were two political parties in the community, and it was not clear what names to use for them. But it was clear what they were, and I was trying to think of names for them. The Bandwagon Party was what I thought of calling people who just wanted to make a certain system popular. And then there was the Freedom Party, which was the people concerned about their freedom as computer users and was determined to have free software to that end. The irony was that the system that the people in the Bandwagon Party wanted to make popular was, in fact, a version of the GNU system. Thus, they were missing the whole point of our work.

So while people were thinking about how to describe these two parties, the people in the other one started using the term "open source." We suddenly had names for the two parties. However, I must say that the open source movement has not been entirely scrupulous in informing people that the community was built by a group with different ideas and a different name.

CPU: Does all commercial software inherently restrict freedom?

Stallman: Not at all. Some commercial software is free software. For instance, there is Mozilla, OpenOffice, various IBM programs, and some programs from HP. There are many programs by Red Hat and others. These are examples of free commercial programs, and there's nothing wrong with this because they respect your freedom. The fact that they're maintained by a business and a business makes money through them somehow is, as far as I'm concerned, entirely good given that the program treats our freedom properly. However, I don't believe in kowtowing to business. Business should exist, but it shouldn't have power.

CPU: If you had your druthers, would you want GNU to be as popular as Windows?

Stallman: All else being equal, yes, because the goal is that free software should replace proprietary software. The goal is that all the users of computers should have freedom. If you're using a nonfree program, it means that somebody else controls what your computer does.

CPU: What would it take to make GNU that popular?

Stallman: I don't know. Basically, no one knows. But I should point out that when people focus on the popularity of a system, say GNU/Linux, as the ultimate goal, it may occur to them that they can make the system more popular by cooperating with someone who develops proprietary software. They may say this proprietary software is helping us because it makes the system, which is actually a version of GNU, more popular. And yet for us in the GNU project, that's missing the point. The popularity of our system is not an end in itself; it's a means to spread freedom. If you taint it with nonfree software, it might be popular, but it isn't spreading freedom anymore. CPU

To read our entire interview with Richard Stallman, go to
www.smartcomputing.com/cpumag/sep02/stallman

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What's Cooking . . .

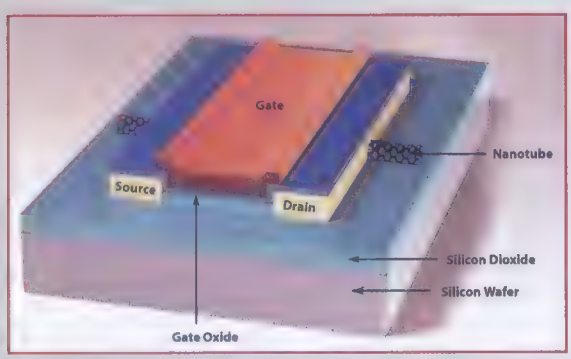
Under Development

A Peek At What's Brewing In The Laboratory

Fresh from the most influential R&D labs around the world, here's a glimpse at some of the technology that scientists, lab techs, and researchers are cooking up for the future.

IBM Nanotubes Outstrip Silicon

When Gordon Moore noted that the number of transistors one can cram into a given square of silicon doubles every 18 to 24 months, he hadn't yet foreseen the demise of optical lithography, the physics-dictated limit to today's CPU fabrication technologies. In the race to build smaller and faster transistor technology, much attention has been lavished on carbon nanotubes. These strands of carbon atoms, measuring less than 1/50,000 the width of a human hair, are the strongest and most conductive fibers known. However, it wasn't until May that researchers at IBM's Watson Research Center (www.watson.ibm.com) proved nanotubes could outperform silicon.



The metal wires in today's semiconductor chips perform well to a point. Replacing them with carbon nanotubes may yield much faster chip speeds with lower power consumption. IBM recently made the first successful demonstration of nanotubes outperforming conventional wires in a CPU-type environment.

In traditional silicon and metal chip technology, individual wires are subject to many resistive forces that interfere with electron movement, thus requiring more power and generating more heat. Because nanotubes are so thin, interfering forces can't bump electrons sideways. This lets designers create lower-power chips and chips with faster transistors.

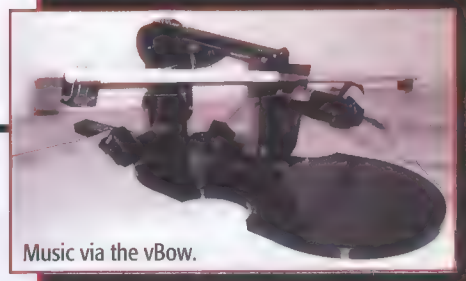
In an IBM announcement, the research group demonstrated it achieved the highest current-carrying capacity (transconductance) of any nanotube structure yet devised. This was done using single-wall CNFETs (carbon nanotube field-effect transistors) constructed similarly to MOSFETs (metal-oxide-semiconductor field-effect transistors), the transistor type common in today's world of integrated circuits. The team's design also yielded more than twice the transconductance of leading silicon MOSFETs.

"Proving that carbon nanotubes outperform silicon transistors opens the door for more research related to the commercial viability of nanotubes," states Dr. Phaedon Avouris, manager of nanoscale science, IBM Research, in a release. "Carbon nanotubes are already the top candidate to replace silicon when current chip features just can't be made any smaller, a physical barrier expected to occur in about 10 to 15 years." ▲

Computerized Music With Feeling

Few of us would use "vibrant" and "heartfelt" to describe computerized music. Synthesizers and even MIDI-based instruments are useful, but they generally lack the subtlety and inflection a musician imbues.

Much of a violin's "personality" comes from how the bow is drawn across the strings. A musician presses harder or softer, faster or slower, to achieve the right sound. Such nuances are generally lost with computerized instruments—unless your using vBow, developed by Charles Nichols (www-ccrma.stanford.edu/~cnichols), a violinist, computer-based musician, and interim technical director of the Center for Computer Research in Music and Acoustics at Stanford University.


Music via the vBow.

vBow hinges on haptic technology (think of force-feedback joysticks). The bow mounts to a mechanical arm system that detects the bow's specific motion in four degrees of freedom. The arm uses motors to exert feedback pressure to simulate how an actual violin would feel under such playing conditions. So, if the bow is tilted at the proper angle, the system detects the musician is playing two strings at once. Feedback systems would minutely increase pressure against the user to simulate the added friction of two strings rather than one.

Nichols is working to implement a pressure-sensitive neck to let the vBow emulate a complete selection of notes across all four "strings." Once complete, vBow-type instruments might compete with acoustic models. Unlike an acoustic violin, however, the vBow can generate sounds, such as a piano and guitar, like a MIDI source. ▲

by William Van Winkle

A Life's Work On A Card

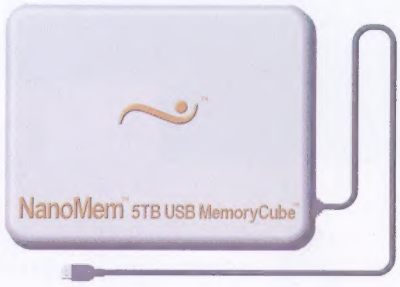
A lot of people got excited when CompactFlash cards finally hit 1GB (enough to store all the books that would fill the back of a pickup truck). Rolltronics (www.rolltronics.com), a leading maker of flexible TFT screens, is using its thin-film roll technology to create tomorrow's solid-state memory storage. By sandwiching an organic material layer between grids of microelectrodes and adding a light and sensing electronics, Rolltronics claims it will soon enable 64GB solid-state PC Cards and 5TB (terabyte) USB packs the size of a 3.5-inch hard disk. Two packs could hold the entire print collection found in the U.S. Library of Congress.

Rolltronics' flexible circuits being tested.

"The memory architecture is so simple that it is some times difficult to understand," says Glenn Sanders, Rolltronics' vice president of business development. "The nanostructures are within the data storage layer of plastic [typically zinc porphyrin, but several other materials also exhibit the same characteristics]. There is no patterning required, and no additional processing of the plastic is required once it is formed. The plastic molecules crystallize into the cylindrical stacks of disks within the sheet of plastic.

"The data storage plastic is hot-coated onto the bottom layer of electrodes. Think of it as extruding a very thin layer of plastic coating onto a thin layer of plastic with imbedded electrodes. On top of that you laminate the top layer of electrodes and then the light source on top of that. The data read/write activity takes place where two electrodes cross. The light and voltage bias causes electron migration within the zinc porphyrin plastic itself directly below the intersection of the two electrodes that have been addressed by the memory interface. And since zinc porphyrin is naturally an insulator, the electrons are trapped even when power is removed. They only change state when both the light and voltage bias are once again applied to that particular point, making it nonvolatile."

Actual electron migration takes place at subnanosecond speeds. What will slow the process down is the memory interface read-write circuitry. Sanders expects this to improve, however. Currently, Rolltronics expects its memory devices will perform at roughly the same speeds as today's standard flash memory products, which is why Rolltronics will target the flash market when it releases its first expected commercial products in 2005. From there, Sanders says Rolltronics' NanoMem line will take on hard drives and even DVDs. ▲



Of Babes & Bomb Chasers

Perhaps you've seen Hasbro's $59.99 My Real Baby, a wondertoy filled with sensors, animatronic routines, and AI-driven behaviors. Although Hasbro made the toy kid-friendly, the brains behind it is a company called iRobot (www.irobot.com), founded by several researchers from MIT's Artificial Intelligence Lab.

iRobot has recently turned to tougher machines. Its PackBot is a robot that looks like a pair of caterpillar-cleated tank treads. Measuring 7 inches high x 16 inches wide x 27 inches long, PackBot has a pair of cleated "flippers" that rotate off of the main treads to help it scoot over and past obstacles such as rocks and stairs. The robot only weighs about 40 pounds and withstands 400G of shock, meaning you could lob it through a second-floor plate-glass window to investigate a hostage situation or scout for enemy snipers or bombs. PackBots were deployed in World Trade Center wreckage following Sept. 11, probing areas to help protect rescue workers.

The PackBot runs on a 700MHz Pentium III and has 256MB of RAM, two CompactFlash sockets, two PC Card sockets, 802.11 networking, and as many as 12 analog video inputs, including options such as night vision.

PacketBot packs a punch.

"The original purpose of the PackBot . . . is to assist soldiers in the field by taking their place as 'point man' when going into dangerous situations," says iRobot's Sharon Campbell. "This same technology can also be applied to the dangers encountered by first responders. . . . The situation is the same in that the environment is an urban area which may be partially or totally destroyed and may be filled with potentially deadly hazards, such as live wires, gas leaks or unstable structures. In both cases, improved sensors and autonomy will allow the robot to act with progressively more independence, thereby reducing operator load and fatigue. Eventually we hope the robot will be able to act in much the same way as a well-trained search and rescue dog, where the operator need only give general goals and the robot handles all the details."

If you don't need an intelligent doll or reconnaissance robot, consider iRobot's CoWorker. It's a knee-high, 802.11b-driven robot you can direct around the office to be your eyes and ears. A microphone-equipped camera on an arm doubles as your virtual head. Does your boss want you to look at plans or attend a meeting four floors down? Just roll your CoWorker there to interact with the other party. (The implications for physically disabled workers are considerable.) CoWorker also includes a surveillance mode for patrolling hallways and warehouses after hours. ▲

Q&A With WenChi Chen

Aside from Intel's advertising machine, the message from competing chip manufacturers is that less speed can mean more functionality. WenChi Chen, president and CEO of VIA Technologies, is one of the world's leading voices in promoting more computers based on applications rather than acceleration.

Q Some of the biggest news coming out of VIA now is your system-on-a-chip efforts, descended from Cyrix's MediaGX efforts many years ago. Where can we expect to see system-on-a-chip showing up in the near future?

WC: Web pads and PDAs will depend on system-on-a-chip, but it may also cover the phone I'm using today. After that, we're looking at TV, audio/video, and the consumer box. In all these areas we see the potential for putting in system-on-a-chip to make these devices much more flexible.

Q Chipsets keep getting better. As a result, do you think we'll start seeing low-end and mainstream sound and video cards disappear?

WC: If add-in cards offer the same performance and quality as integrated chips, they probably won't have much market except for people in the older installation bases. If the card vendors continue to evolve, then there's going to be some room for them. Overall, I think the discreet graphics market is definitely going to come down substantially because of UMA. Discrete audio cards have never been that big of a market.

Q When will we see your 64-bit technology?

WC: We will have our chipset supporting AMD's 64-bit processors, the Hammers, coming soon. AMD will start showing their processor this year, so we will have chipsets to support them. We're also talking with them about having some processors based

on a similar architecture, which will help make receiving Microsoft support easier. Everybody should have the same kind of 64-bit system, but Intel's Merced family basically runs its 32-bit mode in emulation, while AMD's Hammer actually runs 32-bit in a native mode. This will definitely provide a much better performance advantage. So that's the kind of architecture we think will be better, and we are very interested to work closely with them as well as with Microsoft to support that.

Q Is your tiny Mini-ITX motherboard only compatible with Socket-370?

WC: No, we can do the Mini-ITX with different sockets. Our EBGA architecture can run several processor types. The Mini-ITX put together with our "Eden" [C3] CPU family is even better, though, because then you can integrate into things like smart telephones. Telephony hasn't really been a part of the PC experience probably because of the noise. Within the PC you have the fan, which generally creates a lot of noise. But when you start using a fanless CPU as we do, then you can enable things like telephony devices and even high-end audio boxes. The trouble with PC audio today is that you have these fans generating a lot of noise and distortion. But with a fanless CPU, you can use that as the backbone for a high-end audio box or even a high-end entertainment center.

Q This sounds like what Intel did with the Xbox, making a PIII into not necessarily a PC, but a PC-like device that serves some specific application.

WC: We think people don't need that much computation power anymore. It is the connection between systems that people are going to need. It's the consumer "flavor" of the machine people will want. Intel keeps emphasizing high megahertz, but if you ask around, how many people are going to really be able to take advantage of a 3GHz processor? I don't know too many.

Instead, I think people will be really concerned about the kind of power consumption it generates. We're talking about huge power consumption in these new processors. Just look at it from the long-term point of view, assuming we're going to have billions of these kinds of systems and they're going to consume so much power. Intel doesn't seem concerned about this, but it's very real. So we're looking at computing from a different angle. We want to enable a better user experience with much lower power consumption based around a much quieter, basically silent PC.

For our complete interview with WenChi Chen, go to www.smartcomputing.com/cpumag/sep02/chen.

William Van Winkle began writing for computer magazines in 1996. He was first published in 1990, the same year he took his first job in computers. He and his family live outside of Portland, Ore.

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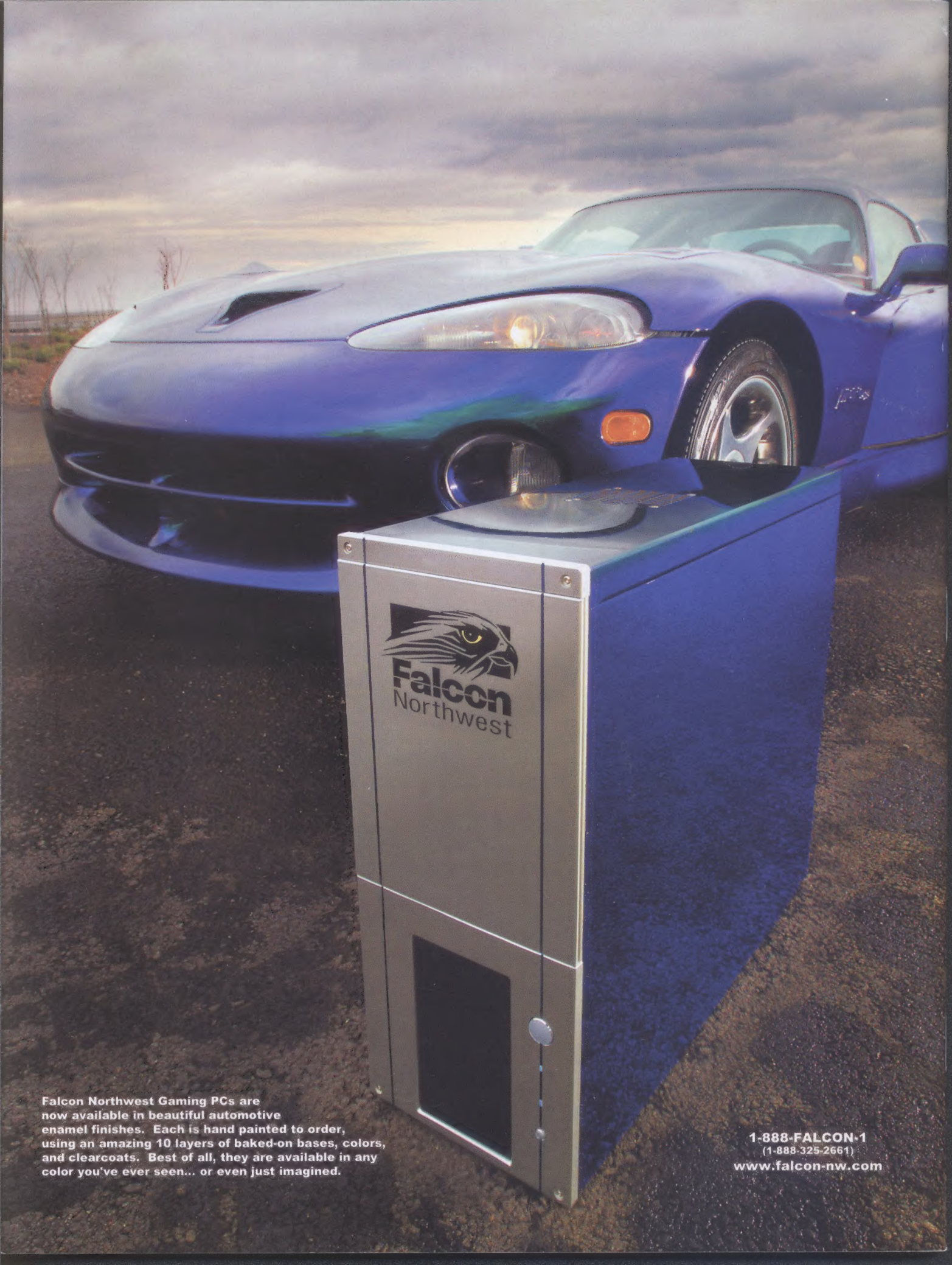

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